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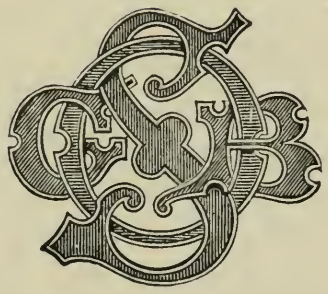
TRANSACTIONS

OF THE

ODONTOLOGICAL SOCIETY

OF

GREAT BRITAIN.



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362

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

November 1, 1897.

Mr. W. E. HARDING, L.D.S.,

President, in the Chair.

The Secretary read the Minutes of the last meeting, which were confirmed.

Mr. C. W. Glassington, Mr. A. T. Hilder and Mr. L. E. Browne signed the Obligation Book, and were admitted members of the Society.

The following gentlemen were then balloted for and unanimously elected members of the Society. As resident members:—W. H. Dolamore, L.R.C.P., M.R.C.S., L.D.S.Eng., 37, Queen Anne Street, W.; Stephen Keele, L.D.S.Eng., 16, Highbury Place, N. As non-resident members:—Norris Snell, L.D.S.Eng., 11, Museum Street, Norwich; Arthur W. Turton, L.D.S.Eng., Belgravia, Goole, Yorks.

Librarian's Report.

The Librarian (Mr. W. A. Maggs) announced the receipt of the following donations: "Dental Surgery for Medical Practitioners," by A. W. Barrett, M.B., by the Author; "Some Methods and Appliances in Operative and Mechanical Dentistry," by R. P. Lennox, by Messrs. C. Ash and

Sons; the *Calendar of the Royal College of Surgeons*, 1897; *Transactions of the New York Odontological Society*, 1896, and the "Year Book of the United States Department of Agriculture," 1896. He also reported that Tomes' "Dental Surgery" fourth edition, had been added to the library.

Curator's Report.

The Curator (Mr. Storer Bennett) presented, on behalf of Mr. Charters White, a specimen of amateur dentistry which was made some years ago, and which Mr. White had had in his possession for a long time. It consisted of a small bone plate with two crudely carved teeth representing lower central incisors. These teeth and the two natural lower lateral incisors had been bound together by a piece of silver wire. The specimen had evidently been worn for a long time, because there was a large piece of tartar beneath the little artificial plate, lying between it and the gum.

Casual Communications.

Mr. H. L. Albert asked the Society to accept two little teeth which were removed from a child 12 months old on account of the inner cusp lacerating the tongue. They were two maxillary deciduous incisors with a sort of inner cusp very largely developed. The teeth were perfectly sound, and so far as he could trace, the influence of heredity had nothing to do with the matter.

Fig. 1.—(A) View of left incisor from palatine aspect. (B) View of right incisor from distal aspect.

Mr. Harry Baldwin thought Mr. Albert would agree with him that the cusps were due to elevation of the cingulum, which was the usual means by which fresh cusps were produced.

Mr. Brunton exhibited a tooth (right maxillary second bicuspid) which he found it necessary to extract owing to its crowded position. As it was rather a difficult matter, before attempting the extraction of it he applied two rubber rings, and the rubber rings were exactly in the position on the tooth exhibited which they occupied when the tooth was extracted. One ring crept up nearly to the apex of the root, and thereby loosened the tooth to such an extent that he was able to remove it quite easily. It was a practice he had used for deciduous teeth, but he had never attempted it before for permanent teeth. He also exhibited two pairs of gold pluggers which he found useful, one especially for matrix work and the other for surface work; and a pair of burnishers, right and left. He also exhibited two pairs of pliers for carrying amalgam to the cavity, which he said were also useful for carrying gold cylinders. Another exhibit he showed was a small instrument for carrying sponges, with a slide which worked up and down to adjust it to the size of wheel required. He also exhibited a simple method of using silk between teeth by cutting a notch at the end of a tooth-brush. Another interesting object shown by him was a lamp used for purifying the air, but which could also be used for annealing gold. It was an ordinary glass spirit lamp filled with methyl alcohol. A sheet of platina foil, crushed together in the centre and drawn up to a point at the bottom, was placed over the wick of the lamp and worked up to form a ball. The lamp was lighted and the flame allowed to heat the platina, and on the flame being put out the lamp continued to glow until the spirit was exhausted. The slow combustion of methyl alcohol under the influence of platinum produces formaldehyde, which acts as a powerful disinfectant.

Mr. Matheson asked, with regard to the tooth exhibited with the rubber rings, whether there was a normal degree of firmness about the tooth, or whether it was loose to begin with. He also asked whether the rings crept up entirely of their own accord, or whether Mr. Brunton helped them up, and also whether a great deal of irritation was created.

Mr. Harry Baldwin said that some time ago a young girl came to him for the purpose of having her teeth regulated, and the complaint about previous treatment was that the upper central, which was being acted upon, had become exceedingly loose and painful. When he examined the case he was very much puzzled, because the tooth was still alive, and yet the gum all round the tooth was exceedingly boggy, and pus was coming down freely between the gum and the tooth. On feeling very high up with a hooked instrument under the gum he felt something like india-rubber, and he succeeded in hauling down from near the apex of the root one of those small india-rubber rings which were used for regulation purposes. It had been overlooked by the previous dentist who had had charge of the case, and had very nearly caused the loss of the tooth. After the ring was removed the tooth gradually got tight and well again. Mr. Baldwin also exhibited two burnishers which were very much thinner than those exhibited by Mr. Brunton, and being perfectly smooth on both sides could be safely insinuated between teeth which were close together.

Mr. Storer Bennett said he did not quite catch the reason given for adopting the method of extraction by elastic ligature; but a case occurred to him some years ago at the Dental Hospital, of a man who was a bleeder, and whenever he injured himself in the smallest degree the hæmorrhage was only controlled with the greatest difficulty. It was absolutely necessary to extract a tooth which was causing much trouble to his tongue, and it therefore occurred to Mr. Bennett that by the slow ulceration of the gum and absorption of the bone, caused by the use of an india-rubber band, the tooth might be extracted without any hæmorrhage. He resorted to that method, but it took a good many days to get the tooth out, and caused a good deal of pain to the patient. The question had been asked by one or two members as to the length of time the process took, and whether it caused any pain. In the case he mentioned it had certainly caused a great deal of pain, and as far as he recollected, it took ten or twelve days.

Undoubtedly, in cases where very severe hæmorrhage was feared, and where one knew it would be very difficult to control the hæmorrhage, that method of operation would be of extreme value.

Mr. Rushton mentioned a case in which four teeth were lost from being ligatured by india-rubber. He also read a short time ago in *L'Odontologie*, a case in which two teeth were lost in the same way. He once tried an elastic ligature on a bicuspid of his own, and although he only put it on in the morning, the pain was so great that he had to take it off in the afternoon. The method, he thought, might be adopted in cases where there was an ingrowing lower bicuspid, and but little room to extract the tooth without causing damage to its neighbours. In such a case a rubber ligature might be of distinct advantage in loosening the tooth and creating a little more space.

Mr. Brunton, in reply, said the tooth was in such a position that it would have been a difficult matter to remove it. The bicuspid was not properly erupted at the time—the crown was just through the gum and turned towards the palate. The first bicuspid and the first molar were close together. The second bicuspid was lying towards the palate, and he could not get anything between the teeth. He saw it was going to be rather a difficult matter to remove it, and so put the rings on. He put one ring on one day and the other on the next, and he pushed the rings well up with a burnisher. He hoped that one of the rings would find its way up and loosen the tooth, and it did most effectually. The patient had to go away soon after he applied the rings, and she did not return for three weeks, and when she returned she told him that she had had a great deal of pain, but he gathered that it was not unbearable.

Mr. W. A. Maggs showed a fragment of the left half of a human mandible, with a tooth lying embedded horizontally in the bone (fig. 2). The ramus and the alveolar portion, as far forwards as the socket of the left canine, were in a state of good preservation. The specimen showed

the sockets of the second premolar and the first molar, and the second molar *in situ*. The unerupted tooth was fully developed, with the apex of the root in contact with the canine socket, the crown immediately above the mental foramen, and the mesial surface placed anteriorly.

Mr. Maggs said that in his opinion the embedded tooth was the first premolar. He regretted he was unable to give any particulars as to where the mandible was found, and he expressed the view that it was probably that of a young adult, about 25 years of age. He formed this opinion from the well-marked surfaces for the attachment of muscles, but the age of the mandible was open to discussion, and judging alone from the molar tooth it indicated that of an older person.

Mr. Carl Schelling read the notes of the following case:—

Mr. President and Gentlemen: In conjunction with this communication which I have the honour of bringing before you, I show a plaster model of an appliance made by me at the earnest entreaty of a lady who very greatly desired to appear round and plump of face as in years long gone by. She first consulted Mr. Tomes, who suggested that I might find the case amusing and instructive, and so I took it in hand.

She was wearing in connection with her upper jaw, five things, namely, a small piece of a vulcanite upper case, with no bands, having a porcelain incisor upon it; two lateral pieces of the same plate; and two very large rolls of paper, first folded and then rolled into flat spirals like small Catharine wheels.

She was very averse to my unpacking her mouth of all its varied contents for fear they might be mislaid; but at length I got all five out, and after excising some very carious incisors, and filling some others, took an impression for a special tray. At the next visit I obtained a plaster impression of the jaw and part of the inside of the cheeks. Subsequently I tried in a plate in the usual manner, and added large masses of wax to it so as to fill each cheek as I

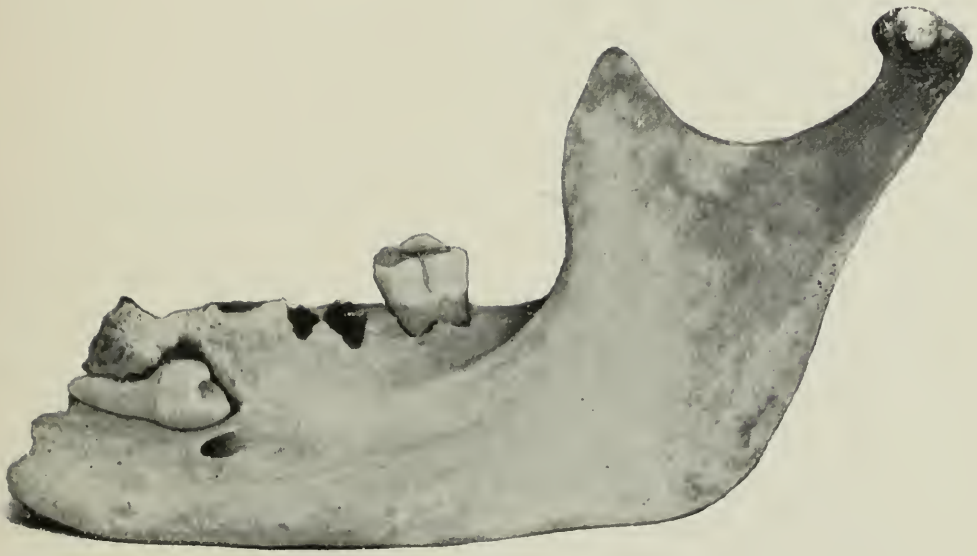


Fig. 2.

thought they should be filled. The case was vulcanised, and the plumpers made hollow, but when I put it in on her next visit, my patient, more in sorrow than in anger, pointed out such faults in my artistic perception of the latent beauties of her face that I cut off the greater part of my plumpers and fixing on two large masses of composition, approximately moulded to the desired shape, sent her home to perfect my attempts before her own mirror.

After she had worn these for a few days I reproduced them in hollow vulcanite. I shall never forget her look of intense gratification when she caught sight of herself in my chimney glass, and though we may not all share her admiration, I ventured to bring this model here to-night in the hope that it might prove amusing, if not instructive, to the members of the Odontological Society.

Mr. Roughton read the notes of the following case of acute suppuration of the mandible, followed by pyæmia and death :—

L. N., a boy aged 7½ years, sat in a draught at school on October 1. The same night he complained of pain in the left side of the face. On October 2 he was seen by his doctor, who found the left side of the face swollen, and temperature 105°. The gum over the left lower molar region was swollen and tender, but the mouth could not be opened sufficiently to inspect the teeth. On October 3, the condition was unchanged. On October 4, the pain and swelling were less, but temperature still high (103°). On October 5, rigors occurred. On October 6 the swelling of the face was less, but had extended to the parts under the jaw as if an alveolar abscess were about to point. Slightly delirious. On October 7 the swelling had extended farther down the neck almost to the clavicle. I saw the boy in the afternoon. After chloroform had been administered I incised the swelling in the neck; no pus was evacuated, but the tissues looked inflamed and as if about to slough. On opening the mouth I found the teeth in the affected part of the jaw healthy, but the first permanent molar was quite loose, and pus welled up around

it on making pressure on the gum. I removed the tooth, evacuated the collection of pus and cleaned the part as effectually as circumstances permitted. The tooth was quite sound. On October 8, symptoms of peritonitis appeared in the morning, and later in the day there were physical signs of pneumonia. On October 9, the patient died. No *post-mortem* examination was permitted.

Remarks.—This case was at first supposed to be one of alveolar abscess. Subsequent events showed that it was not so. It was evidently a case of acute infective panosteitis followed by phlebitis and general pyæmia. Such cases are common in the long bones (especially the tibia and femur), but as far as I know, very rare in the jaws. It is well known that the disease is produced by pyogenic organisms (usually the staphylococcus pyogenes aureus), but the path of entrance is obscure. Probably the organisms enter the body by some small surface lesion, and are carried by the blood stream to a bone, the vitality of which has been lowered by injury or exposure to cold.

I think this case is worthy of the notice of the Society because it is an uncommon one, and because it serves to remind us that what is at first regarded as a mere toothache may sometimes turn out to be fatal disease.

Mr. Storer Bennett said the case was a most interesting one, and, as Mr. Roughton said, served to remind them how serious might be results of what apparently in the beginning was only a very trivial ailment. Mr. Roughton had stated that the case, although at first mistaken for an alveolar abscess, was evidently not of that nature. Without wishing in any way to join issue with Mr. Roughton, he would like to know the grounds on which he arrived at that conclusion. Nothing was said as to the condition of the pulp, but it was very likely, as so often happened in such cases, that the pulp was dead. Mr. Roughton had said that a considerable amount of pus welled up around the tooth when the gum near it was pressed upon, although no pus came from the incisions in the patient's neck. He drew attention to this because it pointed to the fact that the pus was localised round the tooth itself, and had not

at that time extended very deeply. The fact of the tooth not being decayed of course was no ground for supposing there was not an alveolar abscess. He also understood Mr. Roughton to say that there was trismus, which was one of the common accompaniments of alveolar abscesses. He did not dispute the diagnosis; but only wished to know the grounds on which it was arrived at.

Mr. Goadby said he was interested in Mr. Roughton's case, because a short time ago he had a very similar one himself, and he had brought the patient's medical attendant to give the Society some account of the matter. The patient was an old lady suffering from rheumatoid arthritis. She had in her mouth two lower molars and one upper root. The two molars were particularly loose and the gum in a bad condition. The upper root was fairly sound, but both the roots were troubling her, and it was decided to remove them. The patient had heart trouble and various other complications, and it was not thought advisable to give her a general anæsthetic, and they did not care to risk giving her cocaine. They therefore made use of ethyl chloride, and it was particularly on that account that he wished to mention the case. The gum was frozen and the two teeth removed. The instruments were carefully boiled, and sterilised before being used. About a fortnight afterwards it was noticed that the left side of the mouth did not heal and the right did. The first sign was a small black patch, which eventually developed into a bad condition, the whole of the gum sloughing and laying the bone bare. The old lady, who was very ill, succumbed to sapræmia. Unfortunately, he had not an opportunity of making a cultivation from the case, but thought from the general conditions that the sloughing was probably due to the bacillus of malignant œdema. He had had a similar case some two months previously where he had to deal with a partially erupted lower third molar, and in which it was necessary to remove part of the alveolus, to extract a second molar in order to give room for the third molar to erupt. He was rather afraid that the case would go wrong. He was extremely careful to make the parts as aseptic as possible,

but the patient nevertheless got a good deal of ulceration. He made cultures, but did not get any signs of the bacillus of malignant œdema.

Dr. Hickman said the old lady was 69, and had suffered for some years from rheumatoid arthritis. At frequent times she had had attacks of asthma and bronchitis. He first attended her last March. She had mitral regurgitation and a dilated heart. The teeth were giving her a little trouble, and he asked Mr. Goadby to see the case. They did not care about giving her nitrous oxide, partly because she was so neurotic; her friends did not care for her having general anæsthetics, and cocaine, seeing the condition of her heart, was, he thought, contra-indicated. They therefore tried ethyl chloride. About a fortnight afterwards he noticed that her breath was rather offensive, and on looking at her mouth he found that at the situation of the molar socket there was a slight black patch about the size of a split pea. Previously she had had an attack of senile dementia, and had suffered from sleeplessness. The next day her temperature began to go up, and it ran up to nearly 102° F. The whole of the gum on the inside of the alveolus was black and loose, and completely separated from the jaw. The gum was cut away and pure carbolic acid applied, a saturated solution of Condy being ordered as an injection for the mouth; general tonics and alcohol were also presented. On the next day the outer side of the alveolus sloughed, and she died, not from septic pneumonia, which he rather feared, but either from sapræmia or, possibly, a septicæmic condition. During the fortnight after the extraction of the tooth she would persist in having her windows absolutely closed, which might have been a predisposing cause. He mentioned the case because it seemed quite probable that the ethyl chloride destroyed the vitality of the tissues, and in an old woman of that age it might have helped to bring about the conditions he had narrated.

Mr. H. L. Albert said Mr. Goadby's case was somewhat different from Mr. Roughton's. In the one case the symptoms followed on an operation, but Mr. Roughton's case seemed to be a case of either suppuration under the

tooth, as Mr. Storer Bennett suggested, or acute panosteitis. Mr. Goadby's case was undoubtedly due to some septic condition not connected, he should think, with the operation, because he was perfectly sure that nothing Mr. Goadby could have done would have produced that condition. He had seen a case himself in a poor hospital patient who died exactly in the same way, except that she had septic pneumonia.

Mr. F. J. Bennett thought it might be possible that the freezing of the gum in such an aged and infirm person might go far to lower the vitality of the tissues and render them liable to be attacked by germs.

Mr. Roughton quite admitted the justice of Mr. Storer Bennett's criticisms. It was true he was not in a position to state absolutely that it was not a case of alveolar abscess. Still, the tooth he removed looked to him so much like its normal colour, and the suppuration around the tooth was so diffuse and apparently not in the immediate neighbourhood of the tooth, that he made up his mind at the time, perhaps without sufficient cause, that the tooth really had nothing to do with the suppuration. Of course he was unable to prove it.

THE PRESIDENT'S INAUGURAL ADDRESS.

Gentlemen,—Permit me in the first place to express the appreciation I feel of the high honour you have conferred upon me by electing me to the Chair of this Society, which is without doubt the Blue Ribbon of our profession.

I feel deeply gratified by the confidence you have placed in me, but were it not for the able support and assistance of the Council and Officers, of which I feel assured, I should have hesitated to accept so responsible a post.

The branch of the healing art which we practise is so circumscribed and professional societies have, of late years, so largely increased in number, that it becomes each year more difficult to choose a subject for a Presidential Address with any claim to originality.

The early history of the Odontological Society, with the part which it bore in organising our profession, indeed of lifting it from a state of chaos to the dignity of a profession, has been often told by abler pens than mine.

It is just forty years since the first formal meeting of the Odontological Society, for though it was constituted in the previous year the first meeting was not held until January, 1857. During these forty years the advance of our calling has been most marvellous; whether we view this advance from the adaptability and improvement of our appliances or from the advance of our pathological knowledge, we see the enormous strides that have been made.

One of the most noticeable features of this period is the investigation of micro-organisms, a science which we class under the name of bacteriology.

Little did the learned Leeuwenhoeck dream when, more than two centuries ago (1675), he recorded that he had found "viva animalculæ" in his saliva, that this, the first beginning of bacteriology, would lead a couple of centuries later to the inauguration of a new era in the treatment of disease, in which the so-called animalculæ, from being considered as curiosities, would come to be regarded as powers for good or evil of the first importance.

In connection with this subject two names stand prominently above their compeers, Pasteur and Lord Lister.

Pasteur's work in the investigation of fermentation first shed light on this subject. He, like Darwin, approached any subject for investigation with an open mind, searching only for truth. He demonstrated that fermentation was not a purely chemical action but the result of the vital action of minute organisms, and also showed the important part they play in producing decomposition and putrefaction in organic matter.

Further experiment showed that these organisms were not produced by spontaneous generation, but from spores or germs which are found floating in the air.

This led Lord Lister to adopt the use of antiseptics in surgery; a procedure which is so well known to us all, and which will for all time be associated with his name, and has been of such inestimable benefit to suffering humanity.

Our own speciality has not been behindhand in research on this subject. At the Medical Congress in 1881 Messrs. Underwood and Mills read a paper on "Micro-organisms in relation to Decay in Tooth Tissue." Since that time much has been done by many workers in this field. Mr.

Chas. Tomes, Mr. Howard Mummery, Dr. Miller in Germany, Dr. Black in America, and many others, have demonstrated the parts played by these organisms in producing caries.

In a paper read before this Society some time since the author remarks, "if there were no micro-organisms in the mouth there would be no decay of the teeth," and I think this proposition is generally accepted as correct.

The human mouth forms quite an ideal incubator for bacteria. Here we have a moist cavity kept at a sufficiently high temperature, with ready access to the outside air; the interspaces between the teeth, fissures in the enamel &c., forming not only positions for their lodgment but also store-houses for particles of food, together with dead epithelial cells and mucus, on which they flourish, and which only the exercise of the greatest care in the constant use of the toothbrush can remove.

Under these conditions we should expect to find a large variety of organisms in the mouth, but by a process of "survival of the fittest" the constant forms met with in the mouth are generally considered to be about six or eight.

In his work on this subject Dr. Miller gives some most interesting experiments on the action of mouth bacteria on carbo-hydrates, showing that by the fermentation they produce, lactic acid is evolved, an acid which we know has a powerful solvent action on lime salts.

These organisms seem to have a dual action, first by the acid they produce removing the lime salts, and then by a peptonising action on the albuminous matrix of the softened dentine, absorbing and digesting it as food.

As we should naturally expect, the destructive action proceeds more rapidly in the direction of the dentinal tubes, along which the bacteria find their way.

They produce a distension or enlargement of the tubes by the liquefaction of their walls, and often two or more of the

tubes are converted into one by this process; the softening of the dentine going on in advance of the organisms themselves.

In this connection it is interesting to note that teeth affected with pyorrhœa have a remarkable immunity from caries, though the pockets of detached gum round the necks of the teeth are teeming with bacteria.

Doubtless the explanation of this is that, unlike the acid fermentation of carbo-hydrates, the putrefaction from the sockets of the teeth is alkaline, and so does not act on the lime salts.

The enormous increase of caries in the teeth of all civilised races during the last two or three generations is apparent to us all. The question whether this is due to the food of modern life being more suitable for the growth of mouth bacteria, or that such foods and the mode of life which we call civilisation, result in a weak quality of tooth that does not so well resist the disintegrating forces that are at work in the mouth, is one that still requires investigation.

The researches of Mr. Chas. Tomes into the composition of enamel seems to negative the theory that the teeth of the present generation are deficient in any chemical constituent; but may they not be more defective in structure and their constituents more loosely held together than the teeth of our forefathers?

There seems to be little doubt that the hygiene of the mouth has a far wider significance than the question of tooth decay, it being probably the inlet and the incubator for the bacillus of many diseases, and is often the unsuspected source of various forms of septic poisoning. Hence the importance of impressing upon our patients the necessity for systematic and strict cleanliness.

By adopting strict Listerian principles in the treatment

of septic pulps, we are enabled to deal with a class of cases which years ago were a source of great trouble and uncertainty. I well remember the constant dressing of septic canals, continued sometimes over many visits, while we are now able in the majority of cases to sterilise and fill these roots at one sitting. This enables us by adopting a suitable form of crown to bring into useful service badly decayed teeth and roots which would otherwise have fallen an early prey to the forceps.

I have thought that these few remarks on this subject may be of interest to you and only regret that they partake more of the nature of a mere outline of the work of others than of any original research of my own, my time having been devoted to practical work.

It is not many of us that have the aptitude for original research—I will not say that we have not the time, for it is well known that several of our members who have done so much original investigation have at the same time been engaged in busy practice of their profession, but I fear we do not make all the use we might of our spare moments.

Your council are earnestly considering the question of our future habitat. Indeed, during the recess several council meetings have been held to consider various proposals.

I feel sure that whether we retain our connection with the Dental Hospital, moving with them into the new buildings, or migrate farther afield, your council may be relied upon carefully to consider the matter in all its bearings before coming to a final decision on so important a matter.

In conclusion, gentlemen, I would express the hope that more members would take part in the discussions. The Secretaries have the promise of some interesting papers, but there are still, I believe, some evenings to be filled up.

I would also remind you of the great value of casual communications. Many interesting cases come before us in private practice. If we would only follow Captain Cuttle's advice, "when found make a note of," we might each contribute something to the interest and instruction of the members of our Society.

The PRESIDENT having expressed the thanks of the Society to Mr. Charters White for his donation to the museum, and to the members who had contributed casual communications that evening, the Society adjourned until December 6.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

December 6, 1897.

MR. W. E. HARDING, L.D.S.,

PRESIDENT, IN THE CHAIR.

THE SECRETARY read the Minutes of the previous meeting, which were confirmed.

Mr. STEPHEN KEELE signed the Obligation Book, and was admitted a member of the Society.

Mr. GEORGE NICHOLAS WILLIS, L.D.S.Eng., (London); Dr. JOHN E. GREVERS, M.D. (Amsterdam); and Mr. THOMAS EDWARD CONSTANT, L.R.C.P., M.R.C.S., L.D.S.Eng. (Scarborough), were proposed as members of the Society.

Mr. JOSEPH GEORGE TURNER, F.R.C.S., L.R.C.P., L.D.S.Eng., was balloted for and unanimously elected a resident member of the Society.

The LIBRARIAN announced the receipt of the following exchanges:—*The Transactions of the Clinical Society of London*, 1897, and the *Year Book of the Royal Society*, 1896 to 1897.

The CURATOR (Mr. Storer Bennett) reported the receipt from Mr. David Watson of a set of dental instruments, principally for scaling and extracting teeth. They were antique and interesting as showing a particular phase of the profession's development. He also reported having received from Mr. Curnock a specimen of a deciduous molar of an African elephant.

Mr. Mummery showed a gorilla's skull which he had received from Dr. Leon Williams. There was a fracture of the mandible just to the right of the symphysis. The fracture had united and the animal had a very good articulation, and was able to masticate its food perfectly well.

Mr. Mummery also presented two bone dentures to the Museum.

Mr. Storer Bennett said he had put on the table for members to examine a specimen, that had been in the Museum for four or five years, of a gorilla's skull, showing very considerable damage to the bone in the nasal region. He thought it might be interesting for comparison with the specimen of Mr. Mummery's, in showing the enormous amount of damage these animals did to one another when fighting, as was pointed out by Du Chaillu many years ago. The males of nearly all animals fought very much together, especially at the pairing season. He thought that in both cases the fractures were due to fighting.

The President exhibited an elephant's tooth, found when excavations were being made in the garden of a house in Shrewsbury. It was a well-marked specimen from an African elephant, but very small, and was most probably a deciduous tooth. At the Curator's request he had made a plaster model of it for the Museum, because, unfortunately, the owner would not part with the specimen. Probably the explanation of the find was that it was a curiosity brought home from Africa by some former resident of the house, and at his death or removal had been thrown out with a quantity of rubbish, and buried perhaps for very many years.

He remarked that Mr. Mummery's specimen was interesting as showing how much Nature, left to herself, would do.

The Secretary read a letter from Dr. Dudley Buxton regretting his inability to be present at the meeting, and expressing a wish, if an adjournment of the debate on Mr. Thomson's paper could be arranged for, to speak on the subject at the next meeting of the Society.

Mr. Russell Barrett read the following notes on a case of composite odontome. He said: The case I am going to show this evening is very similar to the other composite odontomes which have been reported; but as it has one or two points of interest, I thought I would bring it before the Society.

The patient, G. E., aged 23, came to the Dental Hospital of London, on Saturday, July 3, when I saw him for the first time, complaining of pain and swelling of the right side of the lower jaw.

"*Previous History.*—Three weeks ago patient had severe pain in the right side of mandible. He put on poultices to his face and a large swelling arose. He bore this for one week and then went to his doctor, who lanced the gum; this gave him some relief, and he went on, without further advice, until coming to the hospital.

"Has no recollection of any enlargement or swelling of the jaw previous to the three weeks, and has never noticed any undue prominences about the right side of his face. Cannot remember having had any teeth extracted on that side, and does not know any teeth are missing.

"*Present Condition.*—Patient thin, and looks very ill and worn out by pain. Has well marked swelling over angle of right side of mandible and has slight trismus.

"On examining the mouth the second bicuspid and second and third molars are missing. There is great expansion of the jaw behind the first molar, and on the surface, between masses of granulation tissue a rough, gritty substance resembling necrosed bone, can be seen. On probing one can define a portion of the anterior and external borders."

I diagnosed the growth as an odontome, and after waiting for a model to be taken I asked Dr. Buxton to give the patient gas, and removed the mass with an elevator. It came away after some difficulty, with a considerable amount of the capsule attached to it.

The cavity was syringed out and packed with iodoform gauze, and the patient was told to come on the following Monday to have it repacked. On July 10—that is, a week after the operation—on taking out the packing the crown of a molar tooth could be seen at the bottom of the cavity.

I have seen the patient lately and the tooth is gradually rising to the surface; it will, I think, ultimately come into place and be of use to him.

The odontome is a rough, nodulated, irregular cube, measuring $\frac{7}{8}$ inch antero-posteriorly, $\frac{3}{4}$ inch from above down, and $\frac{11}{16}$ inch across. Weight $102\frac{1}{2}$ grs.

Fig. 1.

On the anterior surface it has a well-marked groove, where it has moulded itself around the root of the first molar, and on its under surface is a deep pit from absorption caused by pressure of the erupting tooth. The capsule, under the microscope, presents nothing but a fibro-cellular appearance. The growth itself is composed principally of hard and osteo-dentine, along with enamel (figs. 2 and 3). The enamel is distributed in a most peculiar manner, as it forms a lining to numerous tubes which permeate the growth.

I have read several books in the hope of finding something with regard to the growth of these tumours, but have only been able to find that they are due to aberrations of the tooth germs; and, in Messrs. Smale & Colyer's book, that during growth they give rise to no painful symptoms.

If this growth is an aberration of the germ of the second molar, it should have commenced to calcify at the fifth year, and have finished calcifying at the seventeenth year. The patient, however, says that neither he nor any of his relations had at any time noticed the swelling and undue prominence of the angle of the jaw; it seems almost incredible that such a disfigurement as was present should have been unnoticed for so long.

FIG. 2. A—Enamel. B—Dentine.

FIG. 3. A—Enamel. B—Dentine.

I should not like to suggest that the tumour grew in the short time the history extends over, but I think it was more rapid in growth than is usually the case with these odontomes. Three things seem to point to this conclusion, viz. :—

(1) The moulding of the anterior surface around the root of the first molar.

(2) The structure of the growth. The dentine is full of interglobular spaces, and the enamel is darkly stained and unfinished looking.

(3) The enlargement of the angle of the jaw not having been noticed until recently.

Cohnheim's theory, that all tumours are due to developmental faults, seems to me to be well borne out in the growth of odontomes. He supposes that more cells than are necessary for a part are produced, the surplus remaining in an embryonic state until called into activity by some irritation or increased blood supply. A large proportion of tumours also occur where the developmental process is complicated ; as where two layers of the blastoderm join in the formation of an organ. All these conditions hold good in the formation of an odontome ; and it seems to me more probable that a portion of the "tooth band" should have remained as a "resting spore," and ultimately formed the odontome, than that an ordinary tooth germ should have become so complicated.

Mr. Storer Bennett said that about 23 was the usual age for the eruption of odontomes, and the mere fact that the swelling in the jaw was not noticed, was, he thought, no evidence whatever that the swelling had not been there for a very long time. It might have been there many years and not been the subject of remark on the part of the patient's friends. He thought the explanation of the cause of the suppuration was a tolerably simple one. The advancing third molar probably caused absorption of the bony septum between it and the odontome, and the sloughing of the capsule was produced by the pressure of the advancing tooth, and hence the suppuration. Sinuses were formed, the pus escaped into the mouth, and for that suppuration the patient sought relief, and then it was that Mr. Barrett

found the odontome. He could not follow Mr. Barrett's reasoning, however, which made him conclude that it was a formation of rapid growth. The period occupied in its development was not shown, by the mere fact that nothing was previously noticed in regard to the size of the jaw.

Mr. Tomes said with reference to the swelling not being noticed, that he once met with a case where he thought it desirable to have a consultation with the general practitioner attending the patient, and with Sir James Paget, regarding an enlargement on one side of the nose, involving the filling up of the groove of the ala of the nose, and a certain amount of the canine fossa in a young gentleman about 21. They all thought rather gravely of the case, and considered there was probably some new growth causing the swelling, and there was a good deal of anxiety about it until an old nurse appeared and said that the boy from his earliest infancy had had an unsymmetrical face. The father and mother never observed it until he was growing up, and the patient had never noticed it himself. The sequel proved that the nurse was right. That case occurred some ten or fifteen years ago, and the patient was all right at the present time.

Mr. Storer Bennett asked Mr. Barrett to present the specimen to the Museum.

Mr. Barrett said he should be delighted to do so after he had taken one or two sections. In answer to Mr. Storer Bennett, with regard to the growth he said he did not base his conclusions entirely upon the enlargement not having been noticed. The grooving on the front of the odontome had exactly modelled itself to the first molar, and it seemed to him that it must have been fairly rapid for that to have occurred, because it had apparently absorbed all the alveolus between itself and the first permanent molar. The grooving might be due to absorption, but the surface did not look like an absorbed surface, being similar in appearance to the rest of the growth. Had the odontome remained in its own crypt and calcified slowly, he should not have thought it would have become grooved in the way it had. He also based his conclusions on the fact that the

calcification apparently was much more rapid than that of a natural tooth.

Mr. W. R. Ackland showed a slight modification he had made in Mason's gag. It consisted of having the jaws side by side instead of one over the other, and so made the wedge going between the teeth much narrower—half the width in fact—than the ordinary gag. The instruments were made by Messrs. Ash and Son.

Mr. Thomson read the following note on "Chloroform in Dental Surgery":—

"Although chloroform is not much used in London as an anæsthetic in dental surgery, it is not so in the provinces and the colonies, as in hospital as well as private practice it continues to be largely used. Having been appointed Dental Surgeon to the Melbourne Hospital, Victoria, in 1883, I found chloroform the anæsthetic generally used. Nitrous oxide was not used there till three years later. Chloroform was given, by any of the resident staff available, in the sitting posture, and without any special preparation, and though I had several cases every week I do not remember any serious difficulties arising. In private practice the family doctor was often brought in to give chloroform, and I learned in this way how dangerous it might become in inexperienced hands.

"Having, however, gained confidence in certain administrators, I operated only with these, and with uniform success. I carried out a number of experiments on dumb animals, and made observations in all kinds of cases, and noticed that at a stage far removed from deep anæsthesia some operations could be performed with safety, and I have often employed it in the preparation of sensitive cavities. I often extracted a number of teeth at this stage, and Dr. Springthorpe, Lecturer at the Melbourne University, read a paper at a meeting of the Odontological Society of Victoria advocating this method.

"Although for so many years I used chloroform with such success, it now finds no place in my practice, for I

rarely require a longer anæsthesia than can be obtained with nitrous oxide. If the general practitioners who still give chloroform knew the special dangers and difficulties in dental cases, they surely would no longer be parties to its administration.

"If country and colonial dentists can be shown that their practice in this matter is an altogether unscientific and out of date procedure, the long list of dental fatalities may be closed."

Mr. H. Baldwin said he supposed there was no reason why ether should not be given in country places and in the colonies. Sometimes they even yet required a long anæsthesia for dental operations, and something better than gas in that respect had to be used. It seemed to him that whenever ether could be used it was decidedly the anæsthetic in preference to chloroform in such cases.

Mr. J. F. Colyer said that one had only to look through the columns of the dental journals to see the large number of deaths from chloroform which were constantly being recorded, compared to those from nitrous oxide or ether. He did not think they had any justification at any time in giving chloroform for the preparation of cavities. They had two drugs—one nitrous oxide and one chloroform ; one was a safe anæsthetic, the other a dangerous anæsthetic. He failed to see why they were to choose the dangerous anæsthetic instead of the safe one. It always seemed to him that in practice patients placed themselves in their hands, and expected from them the best possible advice. Were they justified, therefore, in advising patients to have a dangerous anæsthetic like chloroform, when they had at hand a perfectly safe anæsthetic in nitrous oxide ?

Dr. Hewitt said it might possibly be within the memory of certain gentlemen present that some few years ago he devoted a little time to this very subject, and he had the honour of reading a paper at Edinburgh in which he did his best to place before the members of the British Dental Association the chief facts that were then at their disposal concerning the use of chloroform in dental surgery. He was surprised, as Mr. Colyer had hinted, to find what a

very large number of accidents there had been in dental surgery, and he was led to the opinion—which opinion he had since held, and which opinion he ventured to believe was held by most of them—that chloroform was not a suitable anæsthetic in dental surgery. He thought they would all agree that the first thing which should guide them in selecting an anæsthetic was that it should be the safest known. If they had to use a little more trouble in giving nitrous oxide they should not allow that point to influence them. That was their first duty to their patient. The next duty was to attend to such details as had been found by experience to be necessary; in other words, to have their patients properly prepared, their apparatus in perfect order, and all appliances at hand, in fact, to do everything which could contribute to the comfort and safety of their patients. To put the patient in a chair, avoid all preparations, and administer an anæsthetic which from every side was now known to be far more risky than either nitrous oxide, or ether, was not a thing to be recommended. Chloroform, in addition to being an unsafe anæsthetic, except in very skilled hands, was liable, as they knew, to be followed by some unpleasant after-effects—another very important thing and another disadvantage as compared to nitrous oxide gas. The sitting posture was open to objection not only from the circulatory side, but also, and quite as much, from the respiratory side. When patients were sitting in chairs, and especially when they were more or less deeply anæsthetised with anæsthetics such as ether and chloroform, unless care was taken an asphyxia factor was liable to be introduced. This factor, coupled with the depressing effects chloroform exerted upon the system was liable to be attended by grave consequences. With regard to the effect of shock from an imperfect anæsthesia, he thought the balance of evidence at the present time was to the effect that operations under light anæsthesia were not more likely to be attended by cardiac depression than operations taking place during deep anæsthesia. That there were cases in which chloroform should be used in preference to other anæsthetics there could, of course, be

no doubt, but they were exceedingly few and far between. As an instance he might mention that not long ago it happened to him to have to give chloroform for a dental operation. The patient had laryngeal disease and there was very difficult breathing, and ether or nitrous oxide would have been out of the question ; only in such a case should chloroform be employed.

Mr. W. A. Maggs said Mr. Thomson was to be congratulated upon two things : on having operated upon a certain number of cases under chloroform, and on having discontinued the practice. He felt that if Mr. Thomson had gone on, he might have regretted the course, as it was only a question of time before some dangerous conditions would have arisen. He was fortunate, however, in having been successful, but that was no reason why the members of the Society should fall in with the same view. Having discontinued the use of chloroform, he thought Mr. Thomson would feel he was on safer lines when acting as a dental surgeon if he restricted his practice to the administration of gas, or, as had been suggested, gas and ether for prolonged operations. At any rate, Mr. Thomson had passed through a critical period, and he congratulated him upon being there to tell the Society frankly what he had done.

The President thought it was undoubtedly the fact that chloroform was very largely given in the provinces in dental operations. He thoroughly agreed with the remarks made by Dr. Hewitt and others adverse to the administration of chloroform in dental work.

Mr. Tomes said he himself for a very great number of years, indeed from the very first introduction of nitrous oxide, had consistently and absolutely refused to operate under chloroform. He did not mean to say that had he met with a case, like that related by Dr. Hewitt, where there were laryngeal complications he might not have used it, but he had never met with a case in which it appeared necessary, and he had uniformly and absolutely refused to use chloroform, no matter if the patient had safely taken chloroform a number of times before, and no matter if the medical man who came with the patient strongly urged it.

Mr. Henry Wood said he should very much like to have had an expression of opinion from members with regard to the A.C.E. mixture. He had operated many times when the patient had been anæsthetised with A.C.E. Where a large number of teeth had to be extracted and in certain other cases nitrous oxide would be entirely out of place. For instance, where many teeth which had been troublesome to move, each one requiring perhaps two minutes to dislodge—and he had actually encountered such cases with four, five or six and more of that nature in the same jaws —in such cases he was decidedly in favour of A.C.E., the patients, of course, being thoroughly prepared for it at home.

Mr. C. Robbins said he had never yet had a case where nitrous oxide, or nitrous oxide in combination with ether, had not been sufficient. He had absolutely refused to operate under chloroform unless in the patient's room and under proper conditions, and during eighteen years he had only had two experiences in that direction.

At this period of the meeting Mr. Baldwin moved the suspension of the rules in order that the debate might be continued, but on being put to the meeting it was lost, and the President therefore called upon Mr. Thomson to reply.

Mr. George Thomson briefly replied to the various speakers.

Partial Suppression of Teeth in a Very Hairy Monkey (*Colobus caudatus*).

By Charles S. Tomes, M.A., F.R.S.

The specimen to which these notes relate is numbered 97, 3, 14, 2, in the British Museum collection at South Kensington, and was placed in my hands for description by Mr. Oldfield Thomas. It consists of the skull and the skin of a male animal, and the abnormality of the teeth is such that the idea was at first suggested that it might be a distinct species, in which the teeth were in a state of reduction comparable to those of Proteles amongst the Carnivora.

A closer study of the teeth, however, and the absolute identity of the skin with those of other specimens negatives this idea, and it appears certain that it is an instance of reduction accidental in the individual, and comparable with similar examples of reduction which are occasionally met with in man (Darwin, "Plants and Animals under Domestication," vol. ii., p. 326; Guilford, "The Teeth and Hair," World's Columbian Dental Congress, Chicago, 1894; Tomes' "Dental Surgery," 4th edition, 1897, p. 64).

FIG. 1. Stuffed Specimen of Colobus Caudatus.

These monkeys are remarkable for the great length of the hair all over the body, and especially for the beautiful bushy tail (fig. 1). As has already been mentioned, this specimen shows no abnormality in the quantity, length, or disposition of the hair nor of the nails; nevertheless it is especially interesting to the student of odontology to find that this the only recorded case, so far as I know, of great reduction in the teeth of a monkey, should have occurred in a form which, so far as its hair goes, deviates pretty widely from other monkeys; the more so as Proteles also is distinguished by the possession of unusually abundant hair.

In the human subject, partial suppression of the teeth has been found not only associated with redundant hair, but also with paucity of hair, whilst Dr. Guilford records the absence of hair and abnormality of finger nails in a mother, daughter and son, who, however, possessed teeth normal in size, form and number. And again, hypertrophy of the teeth has been met with in at least one case of redundant hair (in the case of the hairy woman, Julia Pastrana, whose face was covered with hair), so that all we can say is that abnormality in hair is apt to be accompanied by abnormality in tooth development.

If the skull be compared with those of other males of the same species it is found to be only

a trifle smaller in most dimensions, but in the maxilla and the mandible the deficiency in size is far more marked, so that it comes to have a higher facial angle than belongs to the species (figs. 2 and 3).

The posterior tuberosity of the upper jaw bears its normal relation to the other cranial bones, so that the shortening lies mostly in front of this point; the mandible is also shorter (73 mm. against 82 mm. in other specimens) and weaker, whilst its width is nearly normal at the back but is diminished in front, and the chin is more vertical. All the facial aspect of the skull, and especially the zygoma, malar bones, canine fossæ, &c., have a porous appearance.

To pass to the teeth themselves, those present (either as teeth or empty sockets)—

Right side: i. $\frac{0}{\bar{0}}$ c. $\frac{1}{\bar{1}}$ pm. $\frac{1}{\bar{1}}$ m. $\frac{3}{\bar{3}}$.

Left side: i. $\frac{0}{\bar{0}}$ c. $\frac{1}{\bar{1}}$ pm. $\frac{2}{\bar{2}}$ m. $\frac{3}{\bar{3}}$.

Although all the incisors are absent, the appearance of the alveolus is such as to suggest that they may have been once present, although they must have been very small; the upper canines are large, but the lower canines are mere pegs, and the premolars and molars are all much reduced (figs. 2, 3, 4, 5). Although the teeth are so small they have not in the least the characters of re-

FIG. 2. Side view of the Skull and Mandible of a Normal Male Specimen.

FIG. 3. Side view of the Skull and Mandible of the Specimen, with reduced Dentition.

Fig. 5. Mandible of the Specimen with reduced Dentition.

Fig. 4. Mandible of Normal Specimen.

tained milk teeth, but on the contrary present on a stunted scale the characteristics of the permanent teeth.

The upper canines have attained to almost their normal length and width so far as antero-posterior dimensions go, but they are thinned by being much flattened on their inner sides; the left upper canine, perhaps, owing to its being thus thinned, has suffered from wear to the extent of its pulp cavity being opened, and the dentine is stained by blood pigment consequent upon the death of the pulp. It is rather remarkable that these teeth, serving as sexual weapons rather than for the procuring of food, should have attained to a greater development than the other teeth. In the lower jaw the canines are mere pegs (one is lost but its socket remains) and the upper canines were antagonised chiefly by the premolars. In the left upper jaw a small peg-shaped tooth lies close against the canine—this is apparently pm. 3 of the full mammalian detention; then there follows an interval, pm. 4 lying close to and in series with the true molars.

Pm. 4 is lost on the right side, but its socket is there; on the left its crown is much reduced, is cylindrical, and has little indication of cusps; all the upper premolars, apparently, had single roots.

In the mandible pm. 3 is reduced in antero-posterior length, but still is a fairly stout tooth with recognisable characters. Pm. 4 is lost on the right side, on the left it is much reduced as to its crown, which is cylindrical. It had clearly once two roots, but the posterior root has been absorbed and its socket has been filled up with bone, so that after a time this tooth also would have been lost. It is interesting to see this tooth, reduced in functional importance, undergoing absorption like a milk tooth.

Of the true molars m. 1 is the largest of the upper teeth; it has three cusps instead of four, there being but one inner cusp, and it has three roots. On the right side m. 2 and m. 3 are sub-cylindrical and almost peg-shaped; where on the left side they are lost, the sockets show that their roots must have been almost connate, there being but little indication of division into three roots.

The molar series does not reach as far back as the posterior palatine foramen, and the vacant alveolus is very thin edged; it, however, extends back to the normal extent; and the same condition obtains in the mandible, where there is as much as 10 mm. of vacant alveolus behind the teeth

In the mandible m. 1 it is the largest (instead of being the smallest) of the molar series. It is

ovate and sub-cylindrical, and is so much worn that its cusp pattern is not traceable, though it can have hardly had very pronounced cusps; it has two distinct roots.

M. 2 and m. 3 are smaller, cylindrical, and only indistinctly two-rooted.

Only one of the teeth, viz., m. 1, in the upper jaw can be taken to show any indication of tri-tuberculism in its reduction. It is claimed by the advocates of the tritubercular theory that in reduction teeth show a tendency to revert to an ancient tritubercular type, and the frequent suppression of the posterio-internal cusp in the white races (as pointed out by Topinard, "L'Anthropologie," 1892, and Tomes' "Dental Anatomy," 1894, p. 484) has been held to be a reversion of this kind.

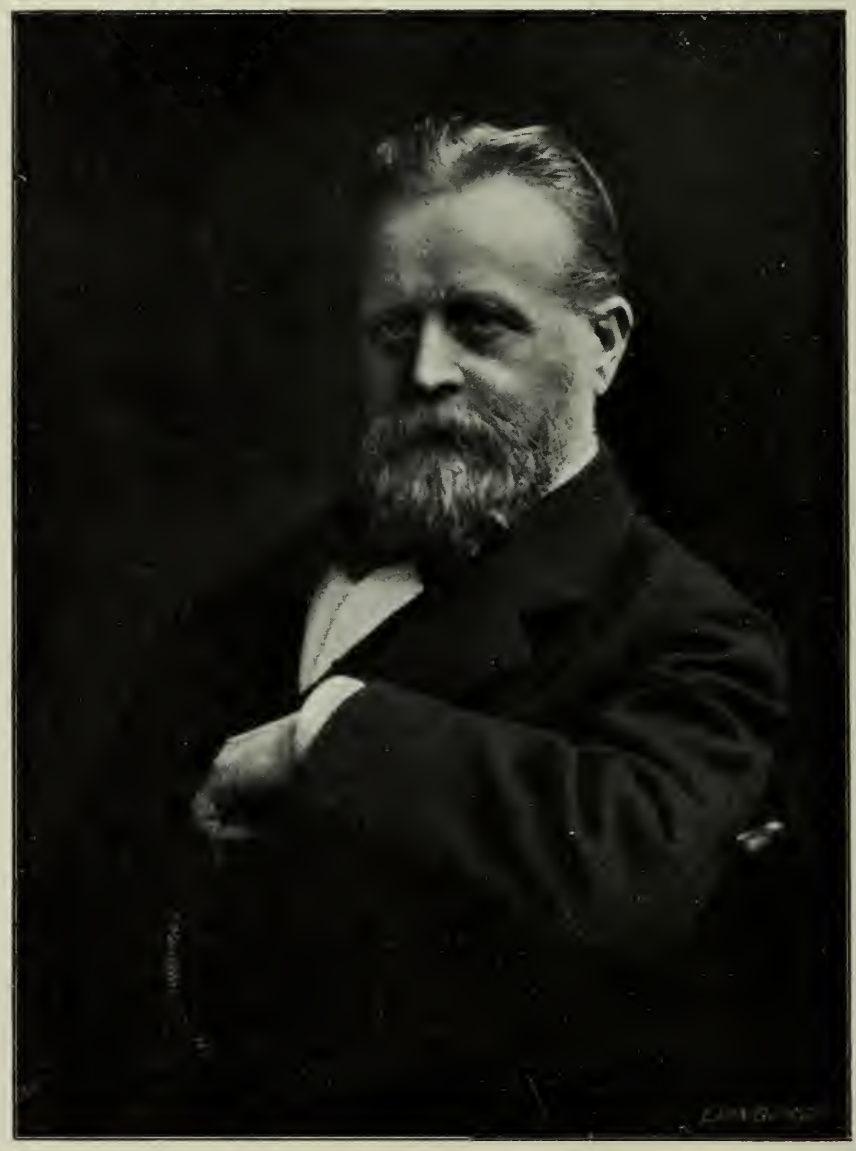
But in this specimen of Colobus, although reduction has taken place in many teeth, it is only in this one that any distinct three-cusped pattern can be seen, so that the specimen does not afford much evidence in support of the theory.

Discussion.

Mr. H. Baldwin asked Mr. Tomes if he were certain the animal never had more teeth than was shown, or if any of the teeth had not possibly been lost in the process of absorption that he had referred to. He should also like to hear about the age of the animal—whether it was an old or a young one.

Mr. Tomes said it certainly had had teeth in the front of the mouth, judging from the condition of the alveolus, but he did not think there had been any more at the back. As to the age, nothing was known save that it was not a menagerie specimen. It was a wild specimen, and the animal was fully adult; and as its teeth were, to a certain extent, worn, it probably reached the usual age of such a monkey.

The thanks of the meeting having been given to those gentlemen who had brought forward casual communications, to Mr. Thomson for his paper, and to the various members who had assisted in the discussion, the Society adjourned until January 10, 1898.



W. Bowman MacLeod, F.R.S.Edin., L.D.S.Edin.

President 1893.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

January 10, 1898.

MR. JOHN ACKERY,

VICE-PRESIDENT, IN THE CHAIR.

THE SECRETARY read the Minutes of the last meeting, which were confirmed.

Mr. W. H. DOLAMORE signed the Obligation Book, and was admitted a member of the Society.

The following gentlemen were proposed for membership of the Society. As resident members: — Mr. FRANK HARSANT, L.D.S.Eng., Fair View, Muswell Hill, N.; Mr. WILLIAM BARNABAS WOODHOUSE, L.R.C.P.Lond., M.R.C.S.Eng., L.D.S.Eng., 1, Hanover Square, W. As a non-Resident member: — Mr. KEVIN E. O'DUFFY, L.D.S.Edin., 85, Harcourt Street, Dublin.

The LIBRARIAN reported, in addition to the usual periodicals and exchanges, the receipt of the *Transactions of the Medical Society of London for 1897.*

CASUAL COMMUNICATIONS.

Mr. CHARLES A. CLARKE explained a system he had adopted of inserting gold fillings into mineral teeth. The teeth are cut with steel discs of various diameters, superfine carborundum powder moistened with water being used.

In his early experiences some difficulty was met with in starting the gold, but that had now been overcome by a method he had adopted, for several years past, in ordinary cohesive fillings. In lieu of starting points he placed, in a suitable position, a pin-head of cement on which was laid a small piece of gold, the cement being allowed to harden before continuing with the filling. Several teeth with fillings of different shapes were exhibited to the members.

Mr. H. Lloyd Williams read the following notes on (*a*) Cases of Excision of Roots, (*b*) Open Bite in an Adult:—

F. H., a girl aged 18, came to the London Dental Hospital, October 26, 1895. The right maxillary central was chipped at the cutting edge, and the apex, with rather more than a third of the length of the root, was necrosed and projecting out of the gum. The tooth was nearly as firm as the left central. The portion of the root that was uncovered was hollow, almost like a quill. There was a history of a fall five or more years ago, followed by pain and swelling; but the appearance of the root through the gum had only been recently noticed. The state of the projecting portion showed, however, that it must have been exposed a very considerable time.

The apical portion was excised as low as possible with a pair of clean cutting-pliers, then with a finishing burr on the engine it was ground until the healthy tissue was reached. The pulp canal was opened, thoroughly cleaned and dressed with iodoform. The wound in the gum was washed with 1-40 carbolic solution and dusted with iodoform. The root canal was filled with osteo as soon as it had been rendered thoroughly aseptic. The wound in the gum gradually closed up until in January there was just a small point of bone still left uncovered. The surrounding tissues were perfectly healthy, however, and I had no anxiety about the future. It is good that I had that confidence, for the patient has never since appeared and cannot now be traced.

The second case is more interesting, though not more instructive. It occurred in my private practice. Seven years ago I treated a dead right maxillary bicuspid for a gentleman aged 25. The roots were filled with gutta percha and a large contour amalgam filling was built up. After going on happily for about four years a gum-boil appeared, and later (March, 1896) the apex of the buccal root protruded. At this time also the large amalgam failed.

The necrosed apex was excised in precisely the same manner as I have already described. The opening of the canal was closed at once and the root prepared for a crown. A Newland-Pedley crown was fixed on; the root was not collared. I was gratified three months ago (October, 1897) to find that the gum was perfectly healed, leaving a depressed whitish scar, and that the crown and root had given perfect satisfaction for eighteen months.

In the first case there certainly was not more than half the normal length of the fang left, and yet the tooth became useful and the gums healed.

There are two points of importance in the treatment of these cases. The first, that the portion of the root that does not protrude shall be healthy, and the second, that after excision by the forceps the root be ground down until the living tissue has been reached and just passed.

F. R. L., aged 25, a cavalry officer, consulted me, November, 1897. He was sent by my friend, Dr. Ball, with whom he was undergoing treatment for obstruction of the nasal passages.

He is a well-nourished, healthy and vigorous man, very well formed with the exception, externally, of a want of proportional growth of the cartilaginous portion of the nose, to the bony. The nasal bones are prominent and well formed, rather wide perhaps; there is a slight depression to the cartilaginous, which then extends straight and fairly regular to the tip, this portion being too small in proportion to the base.

The mouth presents peculiarities other than the irregularity referred to. On the right there is no maxillary

bicuspid at all ; it is supposed it was extracted in a vain attempt to correct the open bite. On the left one bicuspid is missing. In the mandible on the right there is one bicuspid missing. The first molar was honeycombed, but now presents an excellent specimen of arrested decay, all the enamel, excepting on the outer aspect of two small cusps, has disappeared from the grinding surface. On the left the first molar presents a further stage, of recommencing caries ; the whole of the approximal surface is rapidly softening. The second temporary molar remains, but is very loose.

A small depression about the middle of the lower central incisors, a larger nearer the cutting edge of laterals, and a spoilt cusp of the canine, confirm the tale of the first molars. The lower incisors lean inwards in a typical way, the uppers, however, instead of projecting at the cutting edge also incline inwards. The vault of the palate is unusually steep and high. The posterior external cusp of the right maxillary second molar comes in contact with the second mandibular molar, and on the left the posterior cusps articulate between the anterior and posterior cusps of the corresponding lower tooth. A maxillary third molar on the right meets the lower gum.

As a child the patient was very weakly, and was compelled to lie for a very long period because of a spinal injury. Dr. Ball has kindly furnished me with the following account of the condition of the nasal passages. There was an angular deflection of the septum to the left side, completely blocking the left nostril. The condition of the right nostril was such that a slight catarrh would effectually obstruct that passage also. There was evidence of the previous presence of adenoids, which, though now atrophied, very probably caused great inconvenience in childhood. The patient has been particularly liable to attacks of hay fever during recent years. He is a mouth breather. During the last year he has occasionally suffered from gastric neuralgia.

The second and third maxillary molars and the mandibular second molar on the right, and on the left the second molars, were ground until the central incisors, maxillary and man-

dibular, met; the left central and lateral in the mandible had also to be ground down.

For the left mandibular molar a gold crown was made and a saddle-back bicuspid was attached to it to fill the space made by the removal of the temporary molar. On the right the first molar had a gold crown put on it. The latter was seamless, the former was made collar and cap separately (22 c., attached by 20 c. solder).

The models of the mouth before and after treatment are shown. The present condition is: on the right the third maxillary molar meets the gum, and the second molars and first molars articulate efficiently; on the left the first and second molars in the maxilla articulate with the second and first molars and second bicuspid in the mandible, while the central incisors of the maxilla meet edge to edge the incisors and laterals in the mandible.

Mr. H. Lloyd Williams also referred to a case which came under his care at the West London Hospital on January 4. A girl was brought to him with a history that she had an alveolar abscess in the left maxilla. She said that she could not open her mouth; but when he induced her just to open the lips a little he found something very peculiar between the cheek and the gums. On holding the cheek back a little he found the end of a rag sticking out. He took a pair of forceps and got out quite a large piece of rag. The case was apparently an instance of "malingering."

Mr. Schelling mentioned that he had recently seen a case in which Mr. Tomes had sixteen years previously amputated one root of a maxillary molar with the result that the tooth was still doing good service. This treatment had been adopted as an alternative to extraction when the patient was in much pain from an abscess, and was leaving for India next day, and anxious to keep the tooth if possible.

Mr. H. Baldwin said the operation of excising necrosed roots seemed to be very successful in the cases in which it was indicated. On several occasions he had excised the

necrosed ends of the buccal roots of molars and the tips of the roots of maxillary bicuspids in cases where sinuses existed which would not heal, and the necrosed ends were felt distinctly with the probe to be thoroughly separated from all the soft tissues. In those cases, after first trying to cure the sinuses in the ordinary way, he had excised the ends of the roots with a German screw cut fissure burr with most satisfactory results.

Mr. William Hern said he might mention in connection with Mr. Williams' communication that about two years ago he had brought before the Society two cases of excision of necrosed roots; one case occurred in Hospital practice and the other in private practice. In the case in private practice he excised the ends of the roots of the two central incisors. The roots were not projecting through the gum, but were in their normal position below the gum. Chronic abscesses were present in connection with both teeth. The patient came to him asking him to remove the teeth, but, being a young lady, he wished to avoid that method of treatment. He tried to cure the sinuses by dressing the teeth, but he could not get them to heal. He therefore injected cocaine, incised the gum, and with a small fissure burr cut off the end of the roots. The case did well, and he subsequently crowned both teeth. That happened six or seven years ago. He had seen the patient within a year and both roots were firm. With regard to the hospital case, the tooth was a central incisor and the necrosis occurred in connection with a very large cyst. He opened the cyst, and with a curved probe discovered the rough end of a root. In that case he opened the cyst again over the central incisor, came down on the root and excised it. The case did well, but he had not seen the patient lately. In cases in which the buccal roots of molars and the buccal roots of bicuspids had been found projecting through the gum, he had frequently taken a carborundum wheel or fissure burr and cut them off with advantage to the patient, as removing a focus of micro-organic growth. Knowing the tendency of roots so treated to fall a prey to absorp-

tion, he thought it interesting to record his case a success after such a lapse of time.

Mr. Henry briefly mentioned a case of a well-developed supernumerary incisor, which he had met with in a boy 9 years of age.

The Secretary announced that he had received from Mr. R. E. Woodcock a specimen of "false gemination" of two maxillary molars. He also announced the receipt, from Mr. Thomas Nash of Inverness, of a model of an epulis in a woman 65 years of age.

Dr. Grevers exhibited a long series of lantern slides illustrating some diseases of the maxilla and mandible.

The Chairman said he was sure that the slides had proved of great interest to the members, and the members would all feel grateful to Dr. Grevers for having come so far to show and explain them that evening. One point that no doubt would strike them all was the great industry that Dr. Grevers had shown in getting together such a collection.

Mr. Storer Bennett cordially endorsed the views of the Chairman with regard to the indefatigable energy that Dr. Grevers had shown in making such a collection of photographs. He thought in the Society's museum Dr. Grevers would find quite as good specimens of alveolar abscess as any of those he had shown on the screen. Of the specimens Dr. Grevers had shown, the most interesting were those in which the antrum itself was almost entirely obliterated by the formation of new bone. That was an appearance with which he was not familiar, and which was not very often figured in the text-books. The only other criticism he would pass upon Dr. Grevers' exhibition was to say that so many specimens had been shown that it was almost impossible to carry everything away in their minds, and therefore they could not fairly criticise all that Dr. Grevers had brought before them. The exhibition had been a most gratifying, instructive and delightful one.

Dr. Grevers briefly thanked the members for their indulgence. The specimens he had shown were those prepared for his lectures to the students in the Medical University of Amsterdam, but what he would show the students in three lectures he had given the Society in one, and, even then, he had left a number of slides at home which he would like to have shown.

The Chairman said it only remained for him to accord the thanks of the Society to Dr. Grevers for his lantern demonstration and to the contributors for their casual communications. The meeting then adjourned to February 7.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

February 7, 1898.

MR. W. E. HARDING,

PRESIDENT, IN THE CHAIR.

The minutes of the last meeting were read and confirmed.

The following gentlemen were balloted for and elected members of the Society. As a resident member :—GEORGE NICHOLAS WILLIS, L.D.S.Eng. As non-resident members: —JOHN E. GREVERS, M.D., Amsterdam; THOMAS EDWARD CONSTANT, L.R.C.P.Lond., M.R.C.S.Eng., L.D.S.Eng., Argyle Lodge, Scarborough.

The following gentlemen were proposed as members of the Society. As a resident member :—W. MAY, L.D.S.Eng., 32, Oxford Road, Kilburn, N.W. As a non-resident member :—C. A. MALONE, L.D.S.Eng., 63, Plymouth Grove, Chorlton-on-Medlock, Manchester.

The LIBRARIAN acknowledged with grateful thanks the following donations : *Transactions of the Medico-Chirurgical Society*, 14 bound volumes, from 1884 to 1897 ; *Transactions of the Clinical Society*, two volumes, 1896 and 1897, from Mr. Storer Bennett; *Transactions of the Pathological Society*, 9 bound volumes, from 1887 to 1896, from Mr. F. J. Bennett; a " Manual of the Injuries and Surgical Diseases of the Face, Mouth and Jaws," by John Sayre Marshall,

M.D., from Mr. Christopher Heath; and the *Calendar of the Pharmaceutical Society* for 1898.

The Curator (Mr. Storer Bennett) said he had had an opportunity of purchasing for the Society an exceedingly interesting specimen, a piece of secondary dentine from the tusk of an elephant's tooth. It was a piece of very irregular structure, formed as the result of irritation from a leaden bullet which was imbedded in a portion of it. No doubt at some long previous period, the bullet was shot into the growing, thin part of the tusk—the distal end. The bullet was very much flattened, and altogether misshapen. From the laceration it caused, a great destruction of pulp occurred, but ultimately a large amount of very irregular secondary dentine was produced. The bullet, beaten almost out of recognition, after a time ceased to irritate, so that ivory was formed around, and close up to it. The bullet was so intimately surrounded by the ivory as to appear just as much a portion of the structure as the secondary dentine in the neighbourhood. The great point of interest about the specimen was, that had the bullet been of iron, instead of being closely surrounded by ivory, as it was in this instance, there would have been a large cavity in which the iron bullet would have lain quite loose, and if shaken might have been heard to roll about in the cavity; whereas in the specimen shown it was absolutely impossible to obtain the smallest movement of it. In cutting up the specimen the ivory dealer had passed his saw right through the ivory and the bullet, but without dislodging it, and so the bullet was *in situ*. As Dr. Miller had pointed out some years ago in a monograph written on the subject, iron implements of all kinds produce a much greater amount of irritation than leaden ones do.

Casual Communications.

Mr. F. W. Barrett showed to the Society a skull which a friend of his had found whilst travelling in North-west Canada. It came from a place near Vancouver's Island, on the border of a large tract of land known as the Barren

Lands. Those regions were inhabited only by a few wandering Indians and by such animals as the musk ox, which they hunted. From the shape of the skull, and especially from the flattening of the forehead, which appeared to be artificial, and from the very large left mandibular third molar, the only one of that series which happened to remain standing, and from the situation in which it was found, the skull was probably that of a male adult Indian, belonging to one of the aboriginal tribes which inhabited those parts. The chief point of interest lay in the extreme amount of attrition that had occurred in all the teeth. Many of them were worn down beyond the limits of the pulp cavities and in some cases, especially in the left mandibular molars, there were large openings leading into the pulp chambers. The formation of secondary dentine had, in most of the teeth, kept pace with the process of wear, but in the molars referred to this was not the case, and he therefore inferred that the wearing down process had been very rapid and severe. He was told that the food of the people consisted chiefly of frozen fish and meat and uncooked grain, and was probably mixed with a great deal of dirt and ice, the temperature there frequently being at from 40° to 60° F. below zero; and being without the means of cooking their food, they were consequently obliged to eat it in a frozen condition. His friend informed him that amongst the Indians of those regions death from starvation frequently followed close upon loss of teeth. Mr. Barrett did not know that the skull presented any other features of dental interest, except that in the mandible there was evidence of necrosis having taken place at several points, possibly due to the formation of abscesses at the roots of the teeth. He was aware that extreme wearing down of the teeth was a condition not uncommonly met with in savage races, but he thought that the condition shown in that specimen might be of interest to the meeting.

Mr. H. Baldwin said a point which had struck him as being especially interesting was the remark which Mr. Barrett made that the Indians soon after losing their teeth were known to die. It had often struck him that among

all the theories that were brought forward to account for caries of the teeth the one which was based on the Darwinian theory, due to the interference with the working of Darwin's laws, and which caused degeneration in that way, was the one which afforded the best explanation, and to have it definitely mentioned that the Indians on losing their teeth died, apparently from that cause, was a very important point in that connection.

Mr. H. Lloyd Williams said the fact of the teeth being ground down had been very frequently observed, and there were a great number of skulls showing it in the American Museums, and American writers had referred to it. It would be an interesting fact to know, approximately, to which tribe or to what group of tribes the skull belonged. Mr. Barrett referred to the flattening of the forehead. Mr. Lloyd Williams did not remember hearing of the shaping of the head in that way among any of the North American Indians. In Mexico that form of shaping the head was very common, but amongst the Indians about the Hudson Bay and the cold district the plan generally adopted was to tie a flat piece of wood on the top of the head, so as to get that part flat; the skulls were thus easily known as a general rule. The skulls of the Indians in the extremely cold region in the North of Canada were very flat on the top, and not, as in the skull shown, with a very receding forehead.

Mr. Ashley Barrett thought the cause of this great wearing away of the teeth was of interest. One often found the teeth of savages who fed on coarse food with which sand had been mixed accidentally, worn down almost as much as those in the skull shown, but he thought there was here one special cause for the wearing, and he gathered this from reading recently a book by a Mr. Whitney who had been lately travelling and hunting in the Barren Lands. Mr. Whitney said that the staple article of food on which he and his Indian servants lived was fish taken from the lakes and frozen, which they carried with them for months. He also mentionod that the temperature frequently ranged from 40° to 60° below zero. Mr. Barrett thought that at

that very low temperature the icy particles necessarily mixed with the frozen fish must have a great wearing action on the human teeth.

Mr. F. J. Bennett considered that it was not easy to follow Mr. Barrett in his deduction that the Indians were in the habit of masticating ice; physiologically he should think those savages likely to drop off very soon indeed with or without the loss of their teeth. With regard to the dogma that when those people lost their teeth they died off rapidly, it might be put in the other direction, that when they degenerated they lost their teeth. With regard to the wearing down of the teeth, the most crucial test of the rapid wear of the teeth would be found when it was possible to obtain a juvenile jaw and see the erupting teeth side by side with the teeth in use. If they found a first permanent molar much worn by attrition, and a second permanent molar only just erupting, they might be sure that the wear and tear was very rapid indeed. Usually it was understood that the wearing of the teeth was greatest in grain-eating and not in flesh-eating people.

Mr. F. W. Barrett, in reply, said he believed the cause of death from starvation was due rather to inability to masticate food after the loss of teeth. He was unable to name the exact tribe to which the owner of the skull belonged. It came from a place called Fort Rupert, and he thought that many different tribes had mingled there. His friend had told him it was a custom existing among some of the North-West Indian tribes of flattening the foreheads of the children in order to produce what they regarded as types of beauty. From a book by Catlin upon the North American Indians, to be found in the Guildhall Library, he gathered that this custom of flattening the heads obtained among the North American Indians, as well as among those of Mexico.

The Sulpho-cyanide of Potassium in Saliva.

By H. L. Albert.

The methods hitherto employed in the quantitative analysis of the sulpho-cyanide of potassium in saliva are extremely laborious. With the help and at the suggestion of my friend and colleague, Dr. Buckmaster, I have devised an apparatus by which its amount can be estimated with the greatest ease and in a few minutes only. In the hope it may help in unveiling the mystery of the origin, physiological and pathological significance of this characteristic salivary salt, I venture to bring it to your notice this evening.

I would like to introduce the subject with a brief *résumé* of the little that is known about it.

Treviranus[1] was the first to notice the deep red colour produced by the neutral ferric perchloride when mixed with saliva. This was in 1814. In 1826 Tiedemann and Gmelin proved that the colour was due to the formation of the iron sulpho-cyanide.

Jacubowitsch[2] says it exists in mixed saliva in

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[1] Biology, iv., p. 565.

[2] "De Saliva": Inaugural Address. Dorpat.

the proportion of ·006 per cent., Frerichs in the proportion of ·01, Lehmann in the proportion of ·0064 to ·009, whilst Wright[1] states it to be as high as ·51 to ·98 per cent.; the latter observer was, however, faulty in his method of analysis.

Its amount is said to vary in the secretions of the individual glands; thus, in the parotid of man Mitscherlisch[2] and Oehl state it to be ·03 per cent. Maly found traces of it in the sub-maxillary, and Longet discovered a little only in the sublingual.

Oehl[3] attempted a colorimetric estimation with solutions of iron.

Mitscherlisch, Jacubowitsch and Gmelin found it in the parotid of man, dog, horse and sheep, though Lehmann states that it does not exist in that of the horse.

Schiff says it is a decomposition product, and that by keeping saliva for from twenty minutes to half an hour the iron reaction is better seen. I think from my own observation I can dispute this.

According to Munk[4] and Gscheidlen,[5] the salt is constantly found in urine. Musso[6] found it in

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[1] *Lancet*, 1842, "Physiology and Pathology of Saliva."
[2] *Poggendorff's Annalen*, vol. xxvii., 1848.
[3] *Canstatt's Jahresbericht*, p. cxv., 1865.
[4] *Virchow's Archiv*, vol. lxx.
[5] *Pflüger's Archiv*, vol. xiv.
[6] *Bericht für Phys. Chem.*, 1877.

milk, and Leared[1] in the blood. Munk and Gscheidlen found it in the urine of man, horse, dog, ox, cat and rabbit. It is believed by these observers that the salt is absorbed into the blood and constantly removed by the kidneys, since it has not been discovered in the fæces. In urine, however, it exists only in very small quantities, the amount being from ·029 gramme[2] to ·08 gramme[3] in 1000 cc.

Sheridan Lea[4] says it occurs only in the urine of those animals who excrete their nitrogen chiefly in the form of urea.

Heidenhain and Gscheidlen cut the ducts of all the salivary glands in dogs and formed salivary fistulæ. A total absence of the salt was found in the blood and urine, whilst the mixed saliva collected from the ducts contained it.

Carpenter,[5] on the authority of Harley and Longet, says that the salt is absent in the herbivora.

Claude Bernard[6] considers its presence to be due to carious teeth and tobacco smoking.

Lauder Brunton[7] states that in the mollusca

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[1] *Proceedings of the Royal Society*, vol. xviii.

[2] Gscheidlen. [3] Munk.

[4] "Chemical Basis of the Animal Body," p. 163.

[5] "Human Physiology," 9th edition, p. 134.

[6] Bernard, "Leçons sur les Propriétés physiologiques," vol. ii., 1859.

[7] "Pharmacology," 3rd edition, p. 114.

it diminishes reflex actions and quickens the heart-beats, large doses arresting the heart in diastole.

Mons. Chouppé, experimenting on plants, found saliva fatal to vegetable life, and attributed this to the contained sulpho-cyanide; and Hugenschmidt[1] states it to have a distinctly bactericidal property.

Frerichs, Wöhler and others consider it to be non-poisonous in moderate doses. Dr. Florain,[2] in a paper read before a congress held in Paris in 1889, said though fatal to vegetable life it had no action on animals except in excessive doses.

I have tried the ingestion of pure potassium sulpho-cyanide in four rabbits, the amount used being between one and two grammes mixed with about ten of bran a day. In every case death resulted in about a week. The symptoms produced were alike, viz., emaciation and loss of hair. In two a marked atrophy of the salivary glands was found, and in one of these, after dipping in a solution of ferric perchloride, a microscopic examination was made, the ducts being found more deeply stained than the gland tissue. In all four large quantities were found in the urine and fæces, in fact the drug seemed

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[1] *Pasteur Ann.*, 96, tome x.

[2] *Brit. Journ. Dent. Sci.*, 1890.

to permeate, as far as one was able to judge, every organ and tissue, and to find its way in every secretion and excretion, even to the cerebro-spinal fluid. The emaciation was the most marked feature, bearing as it does on the statement of Dr. Fenwick, that the elimination—if it be an elimination—of the sulpho-cyanide by the salivary glands, is a measure of nutrition occurring in largest quantities in the saliva of those who are well nourished, and *vice versâ*. I can from the observation of some few cases confirm this. I should say the emaciation in the rabbits was undoubtedly dependent on the ingestion of the drug, the normal quantity of bran being eaten.

Of the pathological significance Dr. Fenwick, in some lectures on functional diseases of the liver, quoted in the *Lancet* of 1887, points out that those diseases where nutritive efforts are called forth are invariably accompanied by an increase of sulpho-cyanide, and further states that for its appearance in the saliva the bile must enter the duodenum. He adds that as the two are so closely associated it is obvious that the salt owes its origin to some action of the hepatic cells. Dr. Fenwick's means of analysis consisted roughly of a series of shades of colour produced by the admixture of a known quantity of the tincture of the perchloride of

iron in graduated solutions of the salt, the normal colour being obtained by a comparison of the saliva of those whose appearance and history seemed to indicate a normal condition of health. The objections to this method are that the standards of comparison, being fluid, faded after a few weeks; and the tincture of iron, probably owing to the evaporation of the spirit, did not remain at a uniform strength. Dr. Fenwick made no attempt at a quantitative estimate.

Assuming it possible to construct some permanent means of measuring the amount of the salt in saliva it was obviously necessary to avoid these sources of fallacy, hence comparison with coloured fluids was discarded. On the suggestion of Dr. Buckmaster, it was thought likely we could adapt Oliver's hæmoglobinometer to our purpose. This instrument, the outcome of much labour and thought, is a means whereby the quantity of hæmoglobin is found by contrasting solutions of blood with graded red glasses, each of which corresponds to a known percentage of hæmoglobin.

Resolving then to use unfading coloured glass instead of fading coloured fluid as a means of comparison, it was necessary at starting to try the tests for the salt, in order to ascertain which was simplest and which gave the best colour. These tests are: —

(1) The perchloride, discovered by Treviranus, consisting of the production of a blood-red colour on the addition of ferric perchloride, not discharged by hydrochloric acid but disappearing on the addition of corrosive sublimate, thus differing on the one hand from the acetates and formates, and on the other from the meconates.

(2) Böttger's test, discovered in 1872. Filter paper, soaked in tincture of guaiacum, dried and drawn through a 1 in 2,000 solution of copper sulphate, becomes blue when treated with saliva containing potassium sulpho-cyanide.

(3) Solera's, quoted in the *London Medical Record* of 1878, based on the power of saliva of reducing iodic acid. When a weak solution of potassium sulpho-cyanide is mixed with iodic acid it becomes yellow, owing to the liberation of iodine. The test is rendered more sensitive if starch paste is used, the blue colouration produced by the iodine being more easy to recognise than the delicate tints of the yellow. Solera claims such delicacy for it that he can detect ·000004 gramme.

Of these three tests the guaiacum was discarded, it being found necessary to make fresh preparations of that drug so frequently. The perchloride test was chosen, on account of its simplicity and sensitiveness, it being at least as delicate as Solera's.

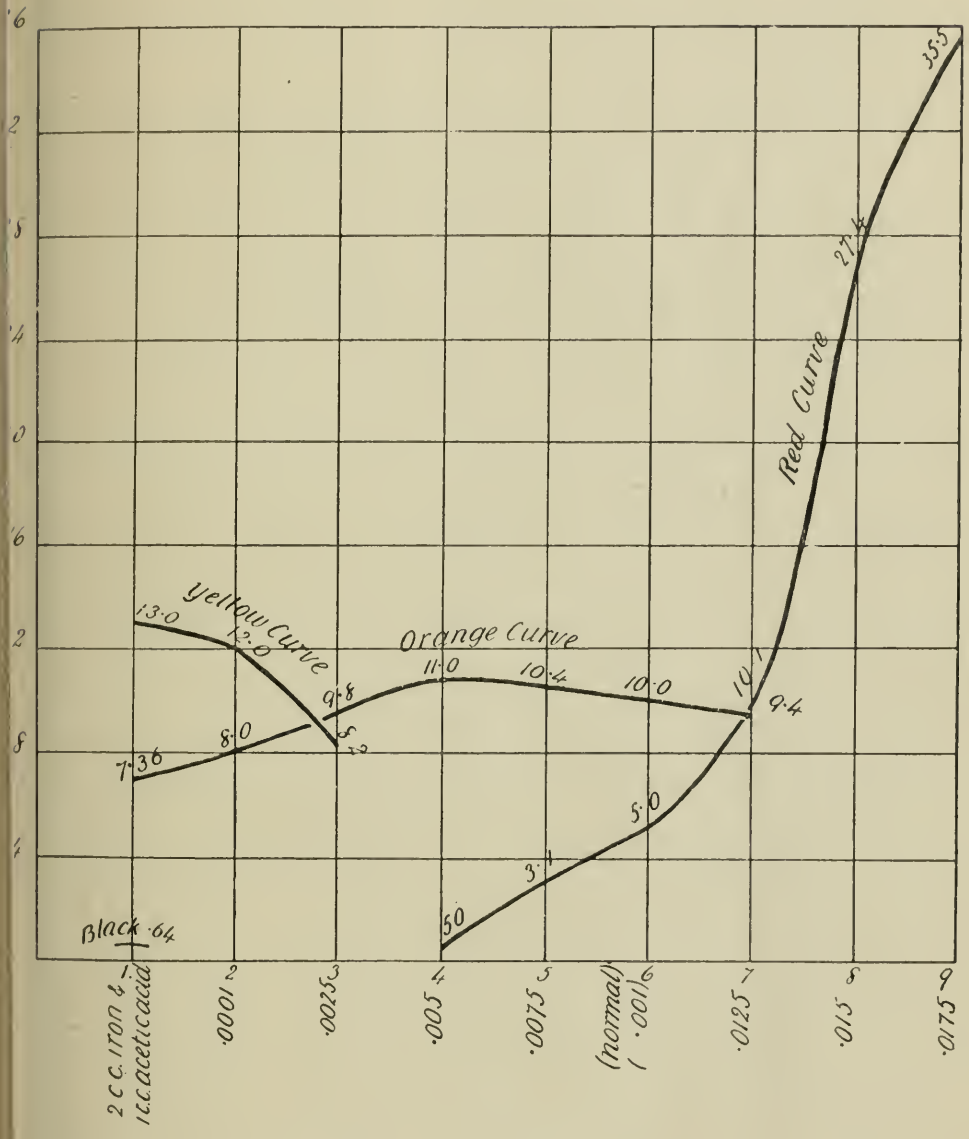
I decided then to use the red colour of the iron reaction, and the next stage in the experiments was to obtain a colour with a solution of the sulpho-cyanide of the same strength in which it occurs in normal saliva. This normal amount was based on the mean of Frerichs' estimate of from ·01 to ·006 per cent.

To a ·008 solution of sulpho-cyanide, therefore, liquor ferri perchloridi was added and sent to Lovibond's Colour Laboratories, Salisbury, in order to have the colour reproduced in glass. In due course they were returned and the colours were found to be exactly matched. It was at once obvious that by a series of graduated red glasses of the same shade as known strengths of sulpho-cyanide solutions to which iron had been added, it would be possible to easily read off the percentage quantity of the salt in different salivas. It was only in the details of the experiments that any difficulties arose; of these the most serious was overcome by my colleague, Dr. Slater. Potassium sulpho-cyanide being so extremely hygroscopic it was found impossible to make up an accurate solution in the ordinary way. Dr. Slater kindly made one, by a titration process, so accurate as to come almost within Frerichs' variations of the normal. The solution was subsequently tested by Dr. Gardner, the lecturer on chemistry and physics at St.

George's, and found practically correct, the exact strength being ·010228 per cent. Not caring to trust to either the tincture of iron or the strong liquor, some trials were made with solutions of the neutral perchloride in order to ascertain the amount necessary to produce the best colour when mixed with the normal solution of the sulpho-cyanide. Some difficulty in weighing the iron occurred owing to its extreme deliquescence. After many trials a 50 per cent. solution was found to suit our purpose best.

Before proceeding further I would like to give a short account of the principle upon which the measurement is based. As, however, it has been so exhaustively described by Oliver in the Croonian Lecture of 1895 no more than a mere abstract is necessary. The colour metric system is used in various ways as a means of quantitative estimation with the aid of colour. Lovibond, the inventor, has fixed an arbitrary and equivalent unit in glass tinted in the three primary colours, the equivalence of the unit being established by the fact that when the corresponding units of the three primary colours are superposed, the colour of each is destroyed, a neutral tint resulting. It is most interesting to note the total abolition of colour produced by the superposition of even the lightest shades of

the dominant colours. The latter are sub-divided into shades and arbitrarily numbered



in series, the shade of one colour corresponding to the number of the shade of the other two

colours. There are necessarily more light shades than dark ones, the human retina only being able to see minute distinctions of colour in light shades. For matching and testing experts are employed.

The chart is a diagrammatic representation of the colours of known solutions of given quantities of sulpho-cyanide, to which a fixed amount of a 50 per cent. solution of neutral ferric perchloride has been added. It is called the "specific colour curve." The numbers below the base line are the percentage amounts of sulpho-cyanide sent for examination, whilst those on the left correspond to Lovibond's own standards of colour. The curve itself is formed by a line uniting the points where the colours of Lovibond's units cross the lines of the sulpho-cyanide solutions. It will be seen, on looking at the chart, that in the weaker solutions of the salt yellow only is discernible, in the medium solutions orange enters into its composition, whilst in the strong mixtures red only is present, the orange and yellow of the weaker solutions being totally disguised. The small numbers on the coloured lines indicate the numbers of the coloured units entering into their composition.

Having thus an unvarying and fixed means of quantitative examination at our disposal, it

only remained to construct a graduated series of shades of red corresponding to the varying percentage of the salt in saliva, as evidenced by the depth of colour produced by the iron reaction, and to make the method of examination itself unvarying. This gave rise to some difficulty for the following reasons :—

(1) Saliva, until it has been standing some time, has a decided colour of its own. Obviously if it were to be compared with coloured glass representing known strengths of sulpho-cyanide, its own inherent tint must be abolished or else that tint must be added to the red of the sulpho-cyanide. Its air bubbles and viscidity, too, were at first a disadvantage to quick work.

(2) Given a clear watery saliva it was necessary to use for each examination the same amount.

(3) To be perfectly uniform, it was of course necessary to use an unvarying light, the changing tones of a London atmosphere being useless.

(4) It was necessary to determine the gradations of the scale to be used.

(5) It was necessary to fix the amount of the 50 per cent. iron solution to be used ; and

(6) To construct a convenient cell to hold the saliva.

(1) The viscidity of the saliva was easily overcome and its colour and air bubbles destroyed by the addition of glacial acetic acid. Saliva

thus treated yielded the same reaction with iron as saliva to which no acid had been added. The proportion of acid employed is 1 in 3.

(2) It was obviously a matter of indifference what quantity of saliva was examined, so long as the same amount was used for each examination. We decided on 2 cc. of the mixed acid and saliva.

(3) The light difficulty was overcome by adopting Oliver's practical suggestion of using double transmission. It was found, as stated also by Oliver, that reflected light showed a deeper colour than singly transmitted light. That of an ordinary candle was employed, the reflecting surface being placed under the cell holding the saliva.

(4) The scale was made to consist of intervals corresponding to an increase or decrease of ·0025 per cent. with the exception of the two lowest shades. Of these one corresponds to a mixture of distilled water and glacial acetic acid in the proportion of 1 in 3, to which ·045 cc. of the iron solution is added. This was of course necessary in order to be able to detect the entire absence of the salt. The other low shade was put in the scale to enable us to detect a mere trace, and corresponds to a ·0001 per cent. solution of the sulpho-cyanide. The scale will thus tell three degrees of increase, the

normal, four degrees of decrease and the entire absence of the salt, the readings being, in order, zero, ·0025, ·005, ·0075, ·001, or normal, ·0125, ·015 and ·0175 per cent. Besides these definite gradations, quarter, half, and three-quarter shades of the intervals were prepared.

(5) The amount of the 50 per cent. solution of the neutral ferric perchloride necessary for each examination is only ·045 cc. The quantity used is more than a hundred times as much as is necessary to combine with the maximal quantity of the salt that has ever been met with in saliva.

(6) A cell was made to hold 2 cc. It was constructed of black vulcanite, the colour used not imparting any additional tinge to the contained fluid, and the acetic acid having no chemical action on it. In consequence of using reflected light it had to be placed on an opaque base, and a base of an absolutely colourless nature. The hydrated sulphate of lime, used by Lovibond for this purpose, was employed. The cell and lime were then cemented on to an oblong piece of glass in order to make it convenient for handling.

Having thus made the requisite colour standards and settled all the details, it was only necessary to send the former to Lovibond's Colour Laboratories at Salisbury to have the colours

matched in glass. They were reproduced so perfectly accurately that no trained eye even could detect the slightest difference. The glasses are mounted in series in a convenient form for handling. The colours of the quarter, half and three-quarter shades were also made. They are, however, only approximately correct, as, curiously enough, though the intervals in the strength of the sulpho-cyanide is practically uniform, it was found that the colour of the fractions of each did not quite correspond. I think, however, they are near enough for all practical purposes. Perfect accuracy could be obtained by having specially prepared glasses made for each interval, but, as it would add to the cumbersomeness of the apparatus—a consideration where clinical investigation is aimed at—and also greatly increase the expense, it was not thought worth while to do this. The glasses corresponding to the fractions are called riders.

The complete apparatus consists of: (*a*) test tube, fitted to economise space, over (*b*) centimetre measure; (*c*) scale of colours; (*d*) cell; (*e*) cover glasses; (*f*) pipette for measuring the iron; (*g*) camera tube for contrasting the colours; (*h*) riders. For clinical work they are packed in a small case, in which room is found for the candles. Besides these, for laboratory work it

is as well to have a metal camera tube on a stand. I have had a miniature dark room made and painted black, to exclude all light but that of the candle placed within it. At the lower aperture of the camera two holes are perforated, under one of which is placed the saliva to be examined and under the other the colour standard with which it is to be contrasted. To one side of the upper aperture a piece of green glass is attached for the purpose of rendering the retina more sensitive to red light should the eye become fatigued.

The method of using the instrument: Some saliva is first collected in a test tube and 2 cc. poured into the centimetre measure. By this little manœuvre the air bubbles are retained in the test tube. To this 1 cc. of glacial acetic acid is added and shaken a little to ensure complete mixing. Next the ·045 cc. of iron is taken up and mixed with the acid and saliva, it being necessary to pass them two or three times up the tube of the pipette to make certain all the iron is added. The cell is then filled from the centimetre measure and a cover glass—which, by the way, is absolutely colourless—placed on top. If the cell is accurately filled to 2 cc. a small air bubble will be seen on the surface of the fluid. It is then placed under one hole of the camera, and the standard with which it apparently

corresponds placed under the other. The candle is then lit and placed in such a position as to equally illuminate the surfaces of both saliva and standard. If the two colours correspond the amount of the sulpho-cyanide is at once known. If they do not, it is only necessary to shift the standards till one is found of the same shade. Should none be found to exactly match, the riders are brought into use, taking care that for every rider employed an additional cover glass be placed on the cell in order to equalise the reflecting surfaces.

Of what use the instrument may be remains to be seen. I have worked with it enough to be unable to confirm Schiff's statement that the sulpho-cyanide increases in saliva that is kept a few hours, owing to decomposition of the fluid. I can also say its existence does not in any way depend either on the presence of carious teeth or on the use or non-use of tobacco.

Discussion.

Dr. Buckmaster said he did not quite agree with the term "co-worker," because the whole of the work had fallen on Mr. Albert. As Mr. Albert had said, he (Dr. Buckmaster) had from time to time helped him with suggestions. He thought everybody would agree that the method was perfectly reliable and excellent. To understand any method was difficult from the reading of a paper. The whole of the experiments connected with the question could be performed in a minute and a half or two minutes. It was a method for quantitative determination of the salt, and depended upon a principle which for the first time had been put into practice by Dr. Oliver for the determination of the hæmoglobin of the blood. For estimating the hæmoglobin of the blood he (Dr. Buckmaster) supposed there existed at the present time nearly twenty different kinds of apparatus in which not one single apparatus was absolutely reliable with the exception of the hæmoglobinometer devised by Dr. Oliver. By the device of using coloured glasses and various standards of colour, examined by monochromatic light if possible, they could for the first time absolutely determine with accuracy the amount of hæmoglobin. It occurred to Dr. Buckmaster that one might apply the same principle to the sulpho-cyanide of potassium in saliva, and he suggested that to Mr. Albert, who had worked the matter out. That the salt varied was undoubted. Year by year, in the observation of hundreds of tests for the sulpho-cyanide, one noticed quite easily that some individuals had absolutely none in the saliva, while others had an excess. That could be

told with the naked eye. With an apparatus of the kind shown, the percentage could be decided at once, and that was of course an advantage. All the methods hitherto existing for quantitative determination of sulpho-cyanide of potassium in saliva had been laborious chemical methods. There was a simpler device by Oehl and another by Dr. Fenwick, and both these were of value, but not of the value they should be, since the standards changed day by day. If they had a varying standard it was quite clear they could not possibly hope to have any result that was worth paying attention to. He thought any advance in a matter of that kind depended on the introduction of a new method. It was recognised daily that it was the introduction of new methods which were really necessary for advances in knowledge of all kinds. Since it was certainly quite a doubtful point as to whether sulpho-cyanide had any relation to caries or not, it was possible that the work of Mr. Albert might have far-reaching results. For the purpose of ascertaining whether there was any relation existing between the presence of the salt in the saliva and caries or other constitutional disturbance, an apparatus such as Mr. Albert had shown was an instrument of great value, indeed, as accurate for the determination of sulpho-cyanide of potassium in saliva as the Oliver-hæmoglobinometer was for the determining of hæmoglobin in the blood.

Mr. Kenneth Goadby agreed with Dr. Buckmaster as to the extreme usefulness of the new method, and its adaptation to the quantitative estimation of the sulpho-cyanide. He congratulated Mr. Albert on having undertaken such a subject. Dr. Buckmaster had referred to the probable relation of sulpho-cyanide and dental caries. Mr. Goadby thought that most of the members of the Society would agree that the theory of caries which generally held the ground was one which quite excluded any idea of the action of sulpho-cyanide. Mr. Albert said that Hugon Schmidt had found that sulpho-cyanide had a distinctly bactericidal action. Mr. Goadby could not confirm that statement himself, because in two of the special mouth organisms — those that Miller described as *the* mouth

organisms—in some cultures he had now, and which he hoped to describe before long, he found that ·5 mgs. per cent. of sulpho-cyanide had no inhibitory action whatever, and that in their growth in an ordinary broth and a sulpho-cyanide broth there was no distinctive difference. Dr. Fenwick in his papers had made several suggestions as to the origin of the sulpho-cyanide in the body, but in making a list of the suggestions as to the origin of the salt Mr. Goadby found that they more or less contradicted one another, so that it was scarcely worth while to cite them all. Dr. Fenwick seemed to think that it depended largely on the bile flowing into the intestines, and he also said it was less in atonic dyspepsia and cancer of the stomach. Neuski had found that the sulpho-cyanide might be formed in the body from the digestion of the nitrils of the higher fatty acids, and he had also shown that if proteids were digested with potassium cyanide the result was a yield of potassium sulpho-cyanide. It was rather an interesting point, and Mr. Goadby recommended it to Mr. Albert's attention. As to the connection of tobacco with carious teeth, Dr. Fenwick took a good deal of trouble to collect evidence, and although his method of estimating the quantities was certainly not a particularly good one, owing to the variations in the standards, he had pretty conclusively shown that sulpho-cyanide did not make much difference. He had found large or small yields of sulpho-cyanide both in smokers and non-smokers, and people with carious and with non-carious teeth.

Mr. Walter Coffin said it certainly seemed to be a very elegant and rapid method of conducting what had always been a tedious and uncertain analysis. Probably to most of the members it would seem a dry and uninteresting subject, but those who had tried to estimate the quantity or even the existence of sulpho-cyanide in saliva would appreciate the great advantage of the method. It was to be hoped that Mr. Albert and Dr. Buckmaster would use it to clear up many discrepancies and contradictions in the text-books on the subject. He thought it should set at rest some moot points still undetermined. Some authorities reported

that sulpho-cyanide was only found in parotid saliva, that it was frequently entirely absent, and so on. It had been considered that sulpho-cyanide might inhibit the activity of mouth bacteria, but he supposed that was extremely doubtful. Certainly they seemed to be quite in the dark as to any useful function in the animal economy of this constituent of the secretion. As to the actual quantity normally present further information was desirable. If he recollected rightly, taking the average numbers reported, the mixed saliva of the human adult secreted in twenty-four hours would contain, of sulpho-cyanide of potassium, one to two grains. It seemed a very surprisingly large amount of an inorganic substance so highly poisonous, and one was struck with astonishment that the human organism should elaborate aimlessly this quantity. A point of interest with regard to the cyanogen compounds was that the earliest knowledge of the oxides of cyanogen was obtained by Scheele, when analysing a specimen of urinary calculus. He revealed the constitution of cyanuric acid, uric acids and urea. It was in that little corner of chemical research, with the synthesis of urea that came from Scheele's discoveries, that the supposed impenetrable barrier between organic and inorganic compounds was first broken down. Mr. Coffin congratulated physiological investigators on having such a very simple method of determining what had been always an exceedingly laborious and very doubtful matter, with the chance of throwing some light upon the very obscure question of the *rôle* of the substance in saliva.

Mr. F. J. Bennett said the Society was very much indebted to Mr. Albert for the apparatus he had shown. Perhaps in dentistry more methods were required than theories. Whether the present method had any bearing on caries or anything connected with the pathology of the teeth did not for the present matter, if it were the beginning of investigations on the part of Mr. Albert.

Mr. Albert thanked the Society for the kindly hearing they had given his paper. Mr. Coffin had spoken of the "secretion" of the sulpho-cyanide of potassium, but Mr.

Albert was not quite sure whether it was a secretion or not. He did not think anybody else knew. One grain a day, however, was rather a lot.

The PRESIDENT, having thanked the author of the paper and the various persons who had spoken, and the donors and contributors to the Library, adjourned the meeting to March 7.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

March 7, 1898.

MR. W. E. HARDING,

PRESIDENT, IN THE CHAIR.

The SECRETARY read the Minutes of the last meeting, which were confirmed.

Messrs. BREWARD NEALE and G. N. WILLIS signed the Obligation Book, and were admitted members of the Society.

The following gentleman was proposed as a resident member of the Society:—F. J. VAN-DER-PANT, L.D.S.Eng., 46, Seymour Street, Portman Square, W.

The following gentlemen were elected members of the Society. As resident members:—FRANK HARSANT, L.D.S. Eng., Fair View, Muswell Hill, N.; WILLIAM BARNABAS WOODHOUSE, L.R.C.P.Lond., M.R.C.S., L.D.S.Eng., 1, Hanover Square, W. As a non-resident member:—KEVIN E. O'DUFFY, L.D.S.Edin., 85, Harcourt Street, Dublin.

The LIBRARIAN (Mr. W. A. Maggs) reported the receipt of the usual Journals and Periodicals.

CASUAL COMMUNICATIONS.

The HON. SECRETARY read for Mr. George Brunton the following communication on "The Strip Matrix."

"A matrix to facilitate the building of gold fillings in interstitial cavities in anterior teeth has been used for many years. It consists of a piece of thin metal, tin, copper, or German silver, about a $\frac{1}{4}$ in. wide and $2\frac{1}{2}$ ins. long; this is interlaced between the teeth in such a way that it will retain its place and give a good wall to build a filling against. The advantages of using a matrix are, a more thoroughly condensed filling, a simplified cavity to work on, and a 'saving of time.' The straight strip matrix has this disadvantage, however well it may fit at the gingival margin, it saggs at the cutting edges and has to be pinched together to bring it close. This is overcome by giving the strip a definite curve. If we take a piece of silk or fine wire and pass it between the teeth close up to the gingival margin, say from canine to canine in the maxilla, and cut off the free ends, then remove it, take another piece and pass it in the same manner, keeping near the cutting edges, and then lay the two pieces together, we shall find that piece which was near the cutting edge is shorter by about $\frac{5}{8}$ of an inch. Working this out we find that an outer circle of $2\frac{1}{4}$ ins. diameter and an inner circle of $1\frac{3}{4}$ ins. gives the proper curves to allow the strip to lie close to the teeth, both at the cervical margins and the cutting edges. For convenience of adjustment the strip is reduced in width at each end on the inner side of the circle. Before adjusting the matrix the rubber dam is put on. Should there be a space between the teeth at the gingival margin and the matrix does not go close, a wedge of wood may be used. It must be fitted to fill the space and cut off close up to the teeth; then when the matrix has been passed alongside the cavity, the wedge is inserted from the lingual side and the matrix folded over so as to retain the wedge in place, while the wedge drives the matrix close up to the cervical margin.

"The metal I find most suitable is platinoid; it is just an alloy of German silver with the addition of about 2 per cent. of Tungsten, and is made by Mr. Martino, of Sheffield.

"The strip matrix is one of those little accessories which makes gold filling both easy and pleasant."

The PRESIDENT said that Mr. Brunton had shown him the matrix a short time ago, and it appeared to him that the aim was principally to cut a matrix to fit the teeth to a definite scale. Mr. Brunton's investigation had shown that by cutting a matrix which was a segment of a circle of a given size, the matrix would fit the majority of contours of mouths.

Mr. BALDWIN thought the originator of the idea of a curved matrix was Mr. Lennox.

Mr. GEORGE NORTHCROFT said he had found, by using the Lennox matrix on front teeth, with a little adaptation it answered all purposes. He had been using this method for over a year, and it certainly seemed to him that Mr. Brunton's matrix was only a repetition of an idea which had already been heard of.

Mr. F. W. RICHARDS read the following notes on a case of composite odontome.

He said: "The communication which I am bringing before the Society this evening is an odontome which was removed from the mandible of a young woman, aged 23. When the patient first came under my notice there was a large swelling in the region of the left second and third mandibular molar teeth; these teeth were absent and there was no history of their removal. The surrounding gums were very much swollen and suppuration had commenced. The patient complained of considerable pain, and stated that she first noticed the swelling about three months previously, and that it had been gradually increasing in size. Upon examination with the probe a hard growth was felt, which a few days later was removed by Mr. Marsh, the odontome being exposed and easily levered out of its position by the bone chisel, the encasing bone being first removed. The patient made a quick recovery and the jaw settled down into a normal condition.

"The odontome was formed of a mass of dental tissues, enamel, dentine and cementum, mixed together, which should have been, if normal conditions had obtained, the left mandibular second and third molars, or the second molar only. The growth measured from before back one inch, from above downwards $\frac{11}{16}$, and from side to side $\frac{11}{16}$."

Mr. J. F. Colyer showed some cases illustrating the diagnostic value of the X-rays. In two cases the patients presented retarded dentitions. In the one patient, whose age was 15, the only permanent teeth present were the first molars, the greater number of the deciduous teeth being present and firm. The patient had been under observation for nearly four years, and no apparent change had taken place in the condition of the teeth and gums. The skiagraphs showed the permanent teeth to be present in the parts of the mouth examined. In the second patient the only teeth present in the mandible were the canines and first molars, and in the maxilla the central incisors, canines and first molars. The skiagraphs showed in the mandible a first bicuspid, and the maxilla also a bicuspid in the parts of the mouth examined. Three other examples were taken to obtain the condition of unerupted teeth in the front part of the maxilla. He also showed two cases illustrating the value of the X-rays in the treatment of irregularities. One specimen showed that a supernumerary was the cause of separated central incisors, and the second specimen the presence of a second lower bicuspid unerupted. In this case the first bicuspid only was present, and there was insufficient room for the second to erupt.

Mr. J. C. Storey also exhibited lantern slides illustrating the following case. In November of last year he was consulted about a girl, aged 9. The patient had had a persistent left maxillary incisor root which had been extracted six months previously, and the present trouble was the eruption of the permanent tooth on the labial surface of the alveolus, nearly half an inch from the gum margin. During the succeeding ten weeks the only observable difference was the clearing away of the gum, so that the coronal edge was distinctly seen. He had taken skiagraphs by means of the X-rays, with a view of determining the direction of the root, as he felt if it were a case of dilaceration there was, of course, no possibility of turning the tooth. He showed a negative of the case, two negatives of the films (two-minute exposures) and two prints of the negatives. The films were wrapped in gutta-percha tissue,

and held in position with the fingers while the photographs were being taken. The skiagraphs showed strong evidence of dilaceration.

Mr. D. P. Gabell suggested that it would be a great improvement in skiagraphs if stereoscopic views were taken, so as to obtain a better idea of the position of the teeth. He had had some taken that afternoon with thirty seconds' exposure. Those taken through the head, from side to side, were four minutes. They had obtained two views from two positions, 40 mm. apart, by moving the tube only, between the exposures. Those views were then put in a stereoscope and a picture was obtained giving a much better idea of the position and shape of the buried teeth.

Mr. Storer Bennett said there was only one point he should like to suggest with regard to the photographs which had been shown, and that was a practical one which would apply to all other lantern slides of models which might be taken in the future. If before taking a photograph of a plaster of Paris model, especially a new one, which afforded very little contrast indeed, the gum and palates were painted either with a mere dirt pigment or with a colour somewhat resembling the gum, the contrast between the teeth, the gums and the palate, would be shown very much better. A mere white surface of the gums and teeth afforded very little contrast, more especially if the model were in a perfectly clean condition—the older the model the better for photographic purposes.

The following short papers were read by Messrs. J. F. Colyer and C. J. Boyd-Wallis.

Formaldehyde in the Treatment of Pulps.

By J. F. Colyer, L.R.C.P.Lond., M.R.C.S., L.D.S.Eng.

For some time formalin (which is a 40 per cent. aqueous solution of formaldehyde) has been employed in surgical and medical practice as an antiseptic, germicide and preservative, and has been found to give excellent results.

Formalin possesses the property of rapidly hardening soft tissues without in any way causing shrinkage, and this, combined with its powerful germicidal properties, suggested its use as an agent in the treatment of the pulp. As far as I can gather, Lepkowski was the first to employ this drug in dental surgery, and in 1895 published a work upon the subject.[1] The results obtained seemed to have been successful, but the severe pain produced by even weak solutions was a distinct disadvantage. During the past year a formaldehyde cement has been introduced by Abraham under the name of formagen, and

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[1] *Formaldehyd als Therapeutisches Mittel in der Zahnheilkunde Verhandlungen der Deutschen Odontologischen Gesellschaft*, vii. bd., Heft 1 und 2.

this preparation seems to give such excellent results that I think it is worthy of discussion at the hands of this Society. Any satisfactory line of treatment by which we could replace devitalization of the pulp and all the subsequent and tedious operations upon the root canals would be a great gain, not only to the operator, but also to the patient.

Formagen, which is a secret remedy in the sense that its composition is not definitely given, is composed of a fluid and a powder (both of which are said to be charged with formaldehyde), which, when mixed together so as to form a cement, slowly gives off formaldehyde. In order to satisfy myself with regard to the composition of formagen, I sent some samples to Mr. E. Lucas, of Messrs. J. Bell and Co., Oxford Street. The powder he finds to be calcium carbonate and a caustic alkali, and the fluid represented approximately by the following :—

Meythyl salicylate ..	1 part
Eugenol	60 parts
Phenol	39 ,,

The first sample sent was one which I had had in use for about one month. Mr. Lucas failed to find the slightest trace of formaldehyde. I then sent him an absolutely fresh sample and asked him to test both powder and fluid for

formaldehyde, and an examination of this showed the slightest trace of formaldehyde.

Similar results were also obtained by my friend and colleague, Mr. Percy Richards, who, in addition to the silver test, employed Schiff's reagent, but with negative results.

In a paper on "Clinical Experiences with Formagen," by Alfred Kunert,[1] the author states that the amount of formaldehyde vapour given off by the cement cannot be detected by the sense of smell (a 5 per cent. solution of formalin emits an intensely pungent odour) but can be determined by the formaldehyde reaction (reduction of ammoniacal silver oxide solution). He also states at the temperature of the body, 37·5° C., he was also able to obtain the reaction.

These results seem, therefore, to be at variance with those obtained by Messrs. Lucas and Richards, but it is possible that the reduction of the ammoniacal silver oxide solution obtained by Kunert may have been produced by eugenol, as this drug acts in a similar manner to formaldehyde on the silver solution.[2]

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[1] *Deutsche Monatschrift für Zahnheilkunde.*

[2] Since reading this paper Mr. Richards has undertaken a test with the view of ascertaining whether formaldehyde vapour is given off from the cement.

The fluid and powder of formagen were mixed together in a test tube so as to form a cement. The orifice of the tube was then corked and sealed and the tube left for

That formagen possesses great germicidal and preservative properties seems to be demonstrated by the researches of Max Bauchwitz.[2] Fresh pulps from calves' teeth were placed in small glass tubes which ended below in pointed orifices, the pulps being so arranged in the tubes that the apical portions were placed at the fine ends of the glass tubes. The pulps were then infected at the apical portions with bacteria from freshly extracted teeth, formagen being applied at the opposite ends and sealed in with cotton wool and wax. The tubes were then placed with the infected parts of the pulps into reagent glasses, which were partly filled with agar-agar culture, and were then deposited in an incubator at the temperature of the body. Max Bauchwitz found that "after one day the reddish pulp was already converted on the surface into a solid, jelly-like structure, which on the second, third, and fourth day, and so on, became uniformly tough up

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twenty-four hours. At the end of this period the cork was removed, water poured into the tube and the cork immediately replaced. The water was then shaken up with the view of dissolving any formaldehyde vapour present. On subsequent testing, a reaction was obtained with the silver solution but not with Schiff's reagent. This latter consists of a dilute magenta solution carefully bleached with a minimum amount of sulphurous acid. If any aldehyde is present the colour of the solution is restored.

[2] *Deutsche Monatschrift für Zahnheilkunde.*

to the extremest point. The peculiar pungent, formalin odour was completely maintained, and nowhere were processes of putrefaction to be observed. *Macroscopical and microscopical investigations demonstrated that no bacteria were present.* The macroscopical investigations were arranged in such a way that I transplanted the pulps, which were taken out of the small glasses upon plates or saucers with agar-agar culture, and these again were deposited for various periods in the incubator. The plates remained completely sterile, *and hence is proved the extremely powerful disinfecting and antiseptic quality of formagen.*"

From observations, too, the same author considers that formagen acts as follows:—The eugenol and carbolic acid act as anæsthetics, the dragging pain at times complained of by the patient being due to the former drug slightly increasing the hyperæmia already present. The formaldehyde vapour then gradually permeates the pulp tissue, killing all pathogenic germs and eventually converting the pulp into a jelly-like homogeneous mass, and stasis occurs.

From clinical observations formagen seems to be an excellent material for the treatment of inflamed and exposed pulps. I have used it now for some nine months in almost every type of case and have found it produce excellent

results, but whether these will be permanent time alone will prove. Curiously enough, although I have used formagen somewhat freely, I have so far had only one case return complaining of after pain, and in this the application of lin. iodi. to the gum soon relieved the troublesome symptoms. This success is, of course, only chance, and I am quite aware that some cases must fail. In using formagen I always protect the pulp from pressure by a large metal cap; this step is not, I believe, adopted by some. The cap, however, seems an essential to success, for however carefully one may insert a filling over the formagen cement, pressure on the pulp may occur and so cause failure, for we all know by experience that in the conservative treatment of "exposed pulps," removal of any pressure on the pulp by means of a metal cap is an essential factor to success and should be adopted equally when employing formagen. I hope members present who have used formalin or formagen will give their experiences, for nothing assists our knowledge of a subject like the free discussion of that subject.

Formalin.

By C. J. Boyd Wallis, L.D.S.Eng.

Formaldehyde, formic aldehyde, or formalin, was discovered by Hoffman in 1867; Loew demonstrated its germicidal powers, and Berlioz and Trillat proved it a powerful disinfectant, free from poisonous properties. It is met with in commerce under the name of "formalin," which is a 40 per cent. solution of formaldehyde, having a specific gravity about 1·070°, possessing a very pungent and characteristic odour. In more concentrated solutions the formaldehyde tends to revert to the polymeric para-formaldehyde, which remains a comparatively inactive white solid, therefore the 40 per cent. solution is the strongest, which will remain permanent. Some formaldehyde, which has been in my possession over four years, in a corked bottle, still retains its pungent odour and its power to coagulate albumen.

Formaldehyde ranks high as a deodorant. Either the solution or vapour will almost instantly remove the putrid odour from decom-

posed animal or vegetable matter, a putrid nerve, mal-odorous breath, urine, fæces, &c.

The action of formaldehyde on gelatine, gelatinous and albuminoidal substances, as an antiseptic, disinfectant, and deodorant, has placed it in the front rank as a bacteriological, medical and commercial agent.

As a hardening agent in microscopy, for the preservation of foods and vegetable structures, it promises to be of the greatest value. The vitiated air of a sick room may be immediately purified by fumigating with formalin, which has a strong affinity for nitrogen and sulphuretted hydrogen. It has no injurious effect upon furniture, silk, wool, cotton, linen, leather, and substances of a like character, and is, therefore, valuable as a disinfectant of clothes and sick rooms. Iron and steel are acted upon by the gas and its solutions, which appear to have no effect upon brass, copper, nickel, zinc, and gilt articles.

The vapour given off by the solution is extremely irritating to the eyes and the mucous membranes of the nose and throat, therefore care is necessary, not only in using it on the teeth, but also in handling strong solutions, as its action on the skin is similar to that of strong carbolic acid.

The following table gives some of the purposes for which formaldehyde may be employed :—

A Solution of Formaldehyde containing—	Effects produced.
1 part in 125,000 parts	Kills anthrax bacilli.
,, ,, 50,000 ,, ...	Prevents the development of typhus bacilli.
,, ,, 32,000 ,, ...	Preserves milk for several days.
,, ,, 20,000 ,, ...	Preserves wines, weak alcoholic liquids and beer, also milk for several weeks.
,, ,, 2,500 ,, ...	Destroys the most resistant micro-organism in 1 hour.
,, ,, 2,000 ,, ...	For rinsing casks and vessels intended for liquids liable to fermentation.
,, ,, 500 ,, ...	As a mouth wash.
,, ,, 250 to 200 ,, ...	A general disinfectant solution for washing hands, instruments, &c., in surgery, spraying in sick-rooms, and as a deodorant.
,, ,, 150 to 100 ,, ...	For hardening microscopic tissues, which should be immersed for a considerable time to give best results.
,, ,, 50 to 25 ,, ...	Sterilises surgical catgut, silk, &c., by steeping.
,, ,, 25 ,, ...	For quickly hardening and preserving for microscopical sections; longer immersion in a weaker solution gives better results.
,, ,, 10 ,, ...	For hardening very firm tissues — In pathological and histological work.
,, ,, 5 ,, ...	For hardening firm tissues — In pathological and histological work.
,, ,, $2\frac{1}{2}$,, ...	For hardening soft tissues — In pathological and histological work.

The above proportions refer to formaldehyde, but if formalin be used then $2\frac{1}{2}$ parts of the latter (40 per cent. solution) may replace each part of formaldehyde.

It was while experimenting with formaldehyde, for commercial purposes, and testing its power of coagulating gelatine that I noticed its deodorant properties, and this led me to test its value in the treatment of the teeth. I found the action of formaldehyde upon certain substances somewhat remarkable as it converts them into

physically different products. In the course of my experiments on plaster and gelatine I found that paraffin subjected to the action of formaldehyde is converted into a white friable powder which gives off formic gas when subjected to heat but it does not so readily melt. It is a powerful solvent for tannic acid and this will prove useful in combination with gelatine in dental and general surgery. I have also found it an excellent local anodyne, giving instant relief to the most severe toothache; this I have proved several times in my own mouth. I have used it several times in combination with arsenic and thus far no pain has followed. I will give one case out of several that have been under treatment at my hands in which three different methods were adopted in the same mouth. Some two years since, I had an opportunity to put formaldehyde to a severe test. In January, 1896, a lady consulted me about her two upper central teeth badly decayed, the right was dead, discoloured, abscessed, with a putrid nerve; this I prepared in the usual way and filled the nerve canal with formic-tannic-catgut, and cement filling to contour; the left central nerve canal I filled with formic-paraffin, and crown with cement to contour. In February, 1898, I again saw the patient and found the cement fillings faulty and the teeth further broken down. I

therefore decided to excise the two centrals and crown. On excision I found the paraffin perfectly sweet and aseptic and easily removed; the catgut was in a similar condition but hard and more difficult to remove and appeared like soft healthy dentine. This and other experience leads me to believe that we shall find the formic-tannic-catgut of the greatest value in root-filling. The third tooth in this case—an upper second bicuspid—was treated in 1896 in a similar way, formic-gelatine to the nerve cavity and amalgam to the crown, this tooth I found perfectly healthy and serviceable.

Several other cases might be cited which have proved equally satisfactory but the above will suffice to show the value of formalin in dental operations. It will form so many combinations that when better understood it will, I think, prove a valuable adjunct to the surgeon's armamentarium as well as to commercial purposes.

I have here a specimen of gelatine which has been subjected to the action of formalin and which renders it insoluble and antiseptic, and when treated also with tannic acid will, I think, prove invaluable as a nerve capping. I have here also some plaster which has been treated with gelatine and subjected to the action of formalin. Unfortunately, it has been dried too quickly and at too great a heat, consequently it

has become slightly browned, and to bring it to perfection it should be subjected to the action of the formalin for a longer time than this specimen has been, but it will suffice to show the result of such a combination.

Discussion.

Mr. Ellwood asked if there were not some confusion in the nomenclature of Mr. Boyd Wallis's paper. Formic-tannic-catgut was a term used in the paper, and it was a little confusing. The paper seemed to be one on formalin, and he should surmise that probably the catgut had formalin as a constituent, but formic acid was another chemical altogether.

Mr. Coffin asked Mr. Colyer to kindly say a little more minutely how he used the metallic cap in combination with the formagen.

Mr. Breward Neale asked the number of cases in which formalin had been used.

Mr. Howard Mummery said he had looked up his book to see in how many cases he had used formagen, and found the number was seventy-one, and out of those he had had four what might be called failures, one in which there had been considerable pain and in the other three discomfort. In the three cases he had to remove it, but he had renewed it in one case, and it had acted successfully. He thought his first failures were due chiefly to not having used a piece of metal for the cap. Parchment or paper he found was not a sufficient protection against pressure.

Mr. Robbins emphasised one point mentioned by Mr. Boyd Wallis. He had not used formagen in his practice, but in January of last year, after his little boy had suffered from scarlet fever, when the local authorities were doing the fumigating in a very slipshod sort of way, he undertook to do it himself, and used a 40 per cent. solution of formaldehyde mixed with a certain proportion of water and evaporated it over a Bunsen burner in every room,

closing all chinks. In a few days he had severe conjunctivitis, and had to be kept in the dark for two or three days. Later on a peculiar form of chemosis showed itself, and a little later still he had to have one eye operated on for a kind of cyst, traced, the ophthalmic surgeon thought, to the irritation caused by the formaldehyde.

Mr. F. J. Bennett asked Mr. Mummery whether he had any selective plan according to the state of the disorganisation of the pulp—whether it was with or without periostitis, or used invariably in all cases of exposure of the pulp. If that information were given, members would get to know better the limits to the application of the new drug. With regard to Mr. Boyd Wallis's remarks as to the disinfection of clothes, he (Mr. Bennett) would warn members it was a mistake to think that formalin did no harm to clothes. Formalin undoubtedly acted on the colouring matter of clothing, and turned them into a very disagreeable brown colour.

Mr. Northcroft did not quite understand from Mr. Colyer's paper whether he used the metal cap in all cases, or whether it was simply a pulp cap where there was a slight exposure. If that were the case he should like to know what Mr. Colyer's theory was in regard to the formaldehyde getting to the pulp. Was the pulp protected by the cap from the drug, or was the cap filled with the preparation?

Mr. J. F. Colyer said most people had been in the habit of putting formagen straight on to the pulp, and then putting the filling on the top. His plan was to put the formagen on in the ordinary way and then put a little cap over the formagen; the formagen, of course, coming next to the pulp in the ordinary way.

Mr. Coffin said with regard to formaldehyde generally, it was certainly a very remarkable chemical substance. Its prompt and rapid combination with such evil-smelling compounds as mercaptan, skatol, sulphuretted hydrogen, and various ammoniacal stinks was very wonderful, forming inodorous compounds very rapidly, and in that way it was evident it would have very extensive uses. It was not quite

as harmless as some people supposed. It might be within the memory of some that a number of infants were nearly fatally poisoned with milk preserved with a very minute portion of formalin. Some eye solutions, such as eserine and atropine, were said to be kept sterilised by about one 100th per cent. of formalin, but any too large proportion would be serious, one might imagine, used in that way. There was a thing about formalin rather interesting, which he had not seen mentioned in the English pharmaceutical or dental journals. If any one remembered the peculiar pungent odour of hamamelis extract, hazeline, or Pond's extract, and compared it with a dilute solution of formalin, the similarity was so great that it had led to the strong assertion (particularly in America) that one of the above constituents of the former was formaldehyde. He, however, did not think that was the case. There was so much mystery surrounding the active principles of hazeline, which many authorities declared at one time had no action whatever, even as a hæmostatic ; the subject was one of interest, and had not been quite cleared up. With regard to formagen, he had not used it much, from a disinclination to using a material the nature of which he was not acquainted with, but he had tried to use formalin in several ways. In the first place there was what was called "formalith" in the market, which was a natural earth saturated with the 40 per cent. solution, and mixed with eugenol, or any similar liquid, to a favourable substance had given very good results, except that he had got pain in a large number of instances, due probably to an excess of formaldehyde. It was also well known that the action of formalin on gelatine was so extraordinary that the hard substance resulting could be reduced to a very fine powder called "glutol," and sold for dermatological purposes. Used dry or in a paste, he was satisfied that it liberated formaldehyde, as it was supposed to do, and certainly was very successful in the treatment of sores and wounds. He had also tried paraformaldehyde, a powder that gave very few of the reactions of formaldehyde, but gradually reverted to it. He had had fairly good

results from the various ways in which he had tried to use formaldehyde in teeth. He had not selected his cases in any way. He thought there was a great future for its use when the best method was found. Mr. Colyer's paper showed that however formaldehyde was contained or liberated by formagen, very much might depend upon the freshness of the material used.

Mr. Morgan Hughes asked Mr. Colyer if he were in the habit of using formagen for root treatments in the case of septic roots; also whether he had used formalin itself, and if so in what strength he was in the habit of using it. It seemed to him that according to the analyses quoted by Mr. Colyer formagen and formalin were two entirely different things, as the former was proved to contain practically no formaldehyde.

Mr. Storer Bennett thought that in fairness to a preparation that appeared likely to be of value to dentists, members ought to bear in mind the instructions which appeared on the boxes of formagen. It was there stated that when the powder and the liquid were mixed together formalin was slowly evolved. He supposed it was intended to be understood that when they were mixed and used in the teeth at about 37° C. the substance would slowly be generated. That might be one explanation of why the analysis failed to show any trace of formaldehyde, either in the fluid or in the powder. He should like to warn all members, as he did some months ago when the subject was first brought up, of the danger of using formaldehyde in the treatment of sensitive cavities. He was very much surprised to hear Mr. Boyd Wallis say in his paper that he had used it with advantage in sensitive cavities, because formaldehyde itself was of an exceedingly irritating nature. If it even got on the fingers the skin was irritated by it, but about the mucous membrane of the mouth it was excessively irritating. In anything so strong as a 4 per cent. solution even it burned the gum considerably. With regard to formagen, in which the formaldehyde was only said to be evolved slowly, there was no pain produced unless it was as the result of pressure. He thought a little

slur had been cast on the substance because it was what was called a secret preparation, and many practitioners objected to dealing with any preparation the constituents of which they did not know; but he would ask them whether they were able to state what were the constituents of the osteoplastics in common use. Nearly every osteoplastic put on the market was claimed to be a perfect filling, and was said to contain new substances, and yet as a matter of fact it turned out nearly always to be very much the same as those in use before. He believed there were few, if any, of the members who knew absolutely what were the constituents of most of the osteoplastics which they were called upon to use. Although formagen was a secret preparation, if it were valuable it ought to be used. He himself did not like quack remedies; but at the same time it was only fair to state that all the osteoplastics were practically quack preparations in the sense that their constituents were secret.

Mr. Dolamore said he had not used formagen, but recently had been reading an interesting paper by Dr. Bönnecken, of Prague, who had been experimenting with formaldehyde for the last two years. He had worked on very rational lines. Knowing the action of this drug on tissues, he reasoned this action would produce on teeth a certain result. For instance, it was a pure coagulant, therefore he applied formaldehyde to a cavity to coagulate the dentinal fibres, and so act as an anodyne. Mr. Boyd Wallis mentioned that he had used it with this object. The result was as anticipated, but Dr. Bönnecken gives a caution against the use of the drug for this purpose, namely, that after a time there is great risk of destroying the pulp. He used a 5 per cent. solution in cavities which were by no means deep, and in a couple of instances, at any rate, he destroyed the pulp entirely. Mr. Dolamore thought, therefore, that possibly they might ascribe the good effect of formagen to the presence of only very small quantities of formaldehyde, because, as he understood it, they were to use formagen for cases in which the pulp was exposed with the expectation of saving the pulp in a live condition, and

not destroying it. It followed that the amount of formaldehyde present must be small. In Germany they were now largely using cements prepared by adding a little formaldehyde to an ordinary cement, using them instead of, and in the same way as, formagen. So far as he had read, the results obtained were equally good.

Mr. J. F. Colyer, in reply, said he quite agreed with Mr. Storer Bennett that they were in the habit of using secret remedies, but it was not a professional thing to do, and because they had done so in the past there was no earthly reason why they should do so in the future.

In the instruction issued with formagen it was distinctly said that the formaldehyde was very slowly evolved, and the experiments of Mr. Kunert, to which he had referred, seemed to support this statement. But as he, Mr. Colyer, had pointed out, eugenol would give exactly the same results with the silver test, so that the result Mr. Kunert obtained might have been from the eugenol and not from the formaldehyde. He asked Mr. Lucas and Mr. Richards if in the preparation he gave them there was anything that produced formaldehyde, and both said they did not think there was. It was a very curious thing that in the two old preparations he had spoken of there was not the slighest trace of formaldehyde, but there was the slightest in the absolutely new one, and it therefore appeared that what little formaldehyde was present at first rapidly disappeared. With regard to the number of cases he could not speak positively, but he should say they were nearer a hundred than seventy-five. He had used it in nearly every class of case of exposed and septic pulp, and had found it especially useful in the treatment of pulps for gouty people and children.

The President having thanked the readers of the papers, and those who had taken part in the discussion, adjourned the meeting until April 4.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

April 4, 1898.

MR. BOYD WALLIS,

VICE-PRESIDENT, IN THE CHAIR.

THE SECRETARY read the Minutes of the last meeting, which were confirmed.

Mr. THOMAS EDWARD CONSTANT signed the Obligation Book and was admitted a member of the Society.

The following gentlemen were elected members of the Society:—As a resident member, Mr. W. MAY, L.D.S.Eng., 32, Oxford Road, Kilburn, N.W.; as a non-resident member, Mr. C. A. MALONE, L.D.S.Eng., 63, Plymouth Grove, Chorlton-on-Medlock, Manchester.

The LIBRARIAN reported the following donation:—"Oral Surgery," by E. W. Roughton, M.D., F.R.C.S., presented by the publishers, Messrs J. P. Segg & Co. He also stated that Kirke's "Operative Dentistry," and the Dental Registers for 1896 and 1897 had been added to the Library. He also acknowledged an old engraving, entitled, "The Dentist Scaling the Ladies' Teeth," presented by Mr. David Hepburn.

CASUAL COMMUNICATIONS.

Mr. S. R. APTHORPE read the following notes on a case of Antral Empyema with Ear Complication:—

The patient, a man about 50, was sent to me by Dr. Curtis, with a previous history of malaria and of gouty

diathesis. He had scarlet fever in 1894 without any ear complication. On December 22, 1896, he came to me complaining of pain in and around the infra-orbital region. I examined and found the right maxillary second molar was crowned, this being the only molar upon that side in the maxilla. The root was not tender upon percussion, neither was there any apparent bulging of any of the antral walls. No discharge from nose, so I again saw patient two days after, when very small discharge had that morning appeared. Gas was administered and the crowned root removed. An opening into antrum was found by a probe, and a quantity of thick pus came away—about one ounce. A rubber drainage tube was inserted and an Ash's antral syringe obtained for use at home. This operation took place on December 27.

About January 5, 1897, the patient was suddenly seized, whilst syringing out antrum through the tube, with violent pain in the middle ear of *left* side. Three days after this a profuse discharge from the ear, which immediately gave relief to pain. Deafness ensued at the time, and has become permanent, although there is now no discharge.

The patient was in the habit of pinching both nostrils in order to empty the cavity of the injected fluids, and in so doing he must have forced some small foreign body, probably a plug of infected mucus, into the opposite Eustachian tube.

The patient subsequently was treated by Mr. Keetley, he making on February 6, 1897, a large opening into the antrum over region of first molar. The antrum was found to be abnormally large, and was scraped and plugged with iodoform gauze, but the packing could not be repeated owing to symptoms of iodoform poisoning, boracic acid solution being subsequently used, and a gradual recovery taking place.

Mr. Apthorpe also read the following notes of a case of accident in a boy involving the maxillary central incisors. The patient, aged 9 to 10, who was at boarding school, fell while playing with his companions, and knocked out his left maxillary central incisor and fractured the right one

somewhat obliquely at the neck, the nerve being fully exposed. This happened on Sunday evening, December 6, 1896, about 9 p.m. The patient received treatment for his fall and was put to bed, no attempt then being made to replace the tooth.

Next day, Monday, I saw the patient about noon, and as the alveolus appeared neither greatly bruised or swollen, I replaced the tooth after taking antiseptic precautions by washing it in a very weak solution of hydrarg. perchlor. The tooth was then ligatured and a fair position obtained, but owing to it not being kept at rest it came out again.

Next day an attempt was made under nitrous oxide to obtain a perfect position, the root being opened through the apical foramen and filled with gold. A splint of gutta percha was adjusted to keep the tooth in place. The patient did not take kindly to the splint and the mouth began to be sore from the fall, so the position was not maintained although liquid foods were given. Three days after, at the request of his friends, I removed the tooth, the root of which already showed a small amount of absorption, the apex being much rougher than before.

The mouth was now allowed to heal, and an attempt made to begin preparations for a crown upon the right incisor root with an extension for the missing tooth; but the youthfulness of the patient upset calculations, and two days after a splint was adjusted with osteo. The splint has now been worn fifteen months, and is keeping the space from being encroached upon in order that the crown may be made when the patient is older. The bar of the splint also aids speech, being used by the tongue in formation of dental letters. The broken incisor root is filled, and is healthy, and is in good position for crowning when the time arrives for that operation.

The Chairman said, in reference to Mr. Apthorpe's case of antral empyema, that he thought it very important that the opening into the antrum should be made large enough to admit of thorough irrigation of the cavity. The trephining instruments usually supplied for this purpose were altogether too small. He showed some instruments

of four- and five-sixteenths of an inch in diameter, with a central bayonet-shaped drill which acted as a guide to retain the trephine in position—a matter of great importance as regards the rapidity and success of the operation.

He mentioned the case of a patient, an elderly woman, whose life at one time was a perfect misery to her, so bad indeed that she thought of committing suicide through the wretched odour of the discharge. She now, by means of irrigation, kept the antrum healthy, and there was very little annoyance. Another case of his had done remarkably well, practically being cured, as it had given no trouble for twelve months, although the opening still existed.

Mr. Charles West read the following notes of a case of persistent temporary teeth in a patient with dichotomous thumbs: The subject of this communication is a youth, 18 years of age, in appearance somewhat cretinous, though not decidedly so; his height, however, being under five feet, with short arms and legs, undoubtedly shows imperfect physical development. He entered the German Hospital suffering from a bronchial affection, and was successfully treated with the usual remedies. The house physician, in the course of his investigations, observed the condition of the lad's mouth and referred him to the dental department; upon examination we found remaining *in situ* nine temporary teeth in addition to all the members of the permanent series with the exception of three bicuspids, and the third molars. Deciduous and permanent teeth were firmly packed together, and if undisturbed by external agency would doubtless have remained a considerable time longer, the double row of teeth having an extremely unsightly and shark-like appearance. In the maxilla there were retained the two temporary canines, the right first temporary molar and the second left temporary molar; the second bicuspid on the left side and the right first bicuspid were just peering through the gum, the right first permanent molar being extensively decayed and preventing the use of that side of the mouth in the function of mastication; as a consequence the models show the

presence of a large quantity of tartar. Turning our attention to the mandible we note remaining on the right side the temporary lateral incisor and second temporary molar; on the left side the temporary lateral canine and first molar; all the permanent teeth are erupted except the right second bicuspid and the third molars; he has, therefore, counting both dentitions, a total of thirty-four teeth, sixteen in the maxilla and eighteen in the mandible, with two bicuspids just showing and the four third molars to follow in due course.

This abnormality is interesting when we consider the patient's age, but the treatment is self-evident, and leaves no scope for discussion. Such being the fact we should have scarcely ventured to bring the case before the Society only that the boy has in addition a congenital deformity, and here, sir, we must pause to apologise for going a little beyond our speciality; but two abnormalities occurring in one individual is the excuse we offer for trespassing upon your time. The last-named deformity consists in bifurcation of the thumbs of both hands, remarkably so on the right hand, where the metacarpal joint seems to resemble a trunk from which is springing two digital branches possessing middle joints and capped with perfect nails; the twin thumbs appear to have started upon an independent career, each turning almost at right angles from its fellow, until the second joint is reached, when a diversion is made in the opposite direction, bringing the tips nearly together; they are nearly equal in relative strength and utility, making it difficult to differentiate the true from the supplemental digit. The same remark does not apply to the left hand, where we have a much more simple deformity; the true thumb is here unmistakably evident; it is, however, defective in shape and strength and is leaning over towards its rudimentary supplement, which is nestling, as it were, beneath the shadow and protection of the stronger member, affording, however, some compensation by giving additional support, thereby indicating nature's endeavour to correct and minimise the inconvenience of bifurcation. An examination of the models shows that the hands are otherwise well

formed for a working lad (he happens to be a carman's help). We much regret being unable to furnish the history of the case; it would be interesting to know whether other members of the family were similarly affected, and whether the dichotomy was the result of hereditary transmission or merely some deviation in embryonic development. The boy came to our rooms in the middle of a busy day; my assistant obtained the models and we then hastily extracted the upper temporary teeth, sending him away with instructions to subsequently return, and get rid of the extraneous lowers. Unfortunately he overheard a remark as to the practicability or desirability of, in early infancy, removing the supernumerary thumbs, and taking fright at the bare suggestion, was never more seen, either at my rooms or at the hospital. We have delayed presenting this report for a considerable time, hoping that circumstances would again bring him under observation.

This deformity is by no means unique, though sufficiently rare to merit recording; as far back as 1862 the late Mr. Chance, in a series of lectures delivered at the Orthopædic Hospital, cites several similar cases; Annandale, of Edinburgh, in 1865, published a work upon "Malformation of Fingers and Toes," illustrating one case almost exactly like the right hand of the case before you; Mr. Clement Lucas, in *Guy's Hospital Reports* for 1881, traces the transmission of supernumerary fingers and toes to a great-great-grandmother, no less than twenty-four out of her eighty descendants, regardless of sex, being thus affected, or 30 per cent. of those carrying her blood, and this notwithstanding the infusion of a foreign strain in each successive generation; he does not, however, mention any oral aberration except in one instance, where the digital deformity is accompanied by hare lip and cleft palate; the details of this case are unfortunately very briefly recorded. Mr. Bland Sutton (to whom this Society has been often indebted), in a series of interesting articles upon dichotomy, published in the *Illustrated Medical News* of 1889, also mentions various recorded cases. A perusal of these authors would amply repay those members who desire further knowledge upon the subject.

In conclusion, sir, we do not claim that the double deformity is more than a coincidence, but inasmuch as excessive development in one part of the physical structure is co-existent with retarded development in another, and in Mr. Lucas's case of surplus digits being accompanied by hare lip and cleft palate, and further, a relative of my own whose mental capacity was deficient, even to the verge of idiotcy, was said to have had six toes on each foot, of this I cannot vouch as I never saw them uncovered, but he wore boots far too wide for the necessities of normal feet; I can, however, affirm that although he had arrived at man's estate his teeth were deficient in number and quality, my memory serves me to state he had two imperfect maxillary centrals, no laterals, and very pointed canines, also a deficiency of lower incisors; he has been dead some years, and during his lifetime the subject did not interest me sufficiently to make more than mental notes. With these facts before us it is just possible that if our observations were more extended some analogy might be established between the two abnormalities; we merely throw out the suggestion in the hope that surgeons may be induced to extend their examinations to the oral cavity when confronted with dichotomous deformities.

The Chairman mentioned a case which he had seen of a somewhat similar character. The patient was a farmer's son and had two thumbs very perfectly formed. His general health was good. He considered that the retention of the temporary teeth was not such a very uncommon occurrence. His brother, aged 40, had four temporary molars and as perfect a set of teeth as one could wish. He had recently seen a boy, aged 9 years, with all his temporary teeth, who was only just cutting his mandibular right permanent molar. The boy was very delicate in health. The Chairman also exhibited an interesting specimen of dichotomy in the skull of a young lamb.

Mr. F. J. Bennett was much indebted to Mr. West for his very interesting communication. All pathological conditions interested the members, whether connected with their own speciality or not. To him the special interest

of the case was that there should be not only an irregularity as to the number of teeth, but that it should be associated with dichotomy or any other abnormality of the body. As far as he was concerned he had not heard of the association of those conditions before, and it was one that would be very well worth looking up by those who had time to do so. It would be possible perhaps to form a series, in which from such things as dichotomy and irregularity in the number of teeth, right up to the extreme form of parasitic fœtus in which all the structures of the body were duplicated, as Mr. Bland Sutton pointed out and showed specimens of some years ago. The laws governing the excess or deficiency of teeth were not known, there were many theories which had been formed from time to time, ingenious in their way, but none of them sufficiently convincing to hold the field entirely unopposed. It was only by collecting facts and putting them on record that any generalisation could be hoped for in the future, and he thought the members were indebted to Mr. West for showing his specimen.

The Use of Gutta Percha in Conservative Dentistry.

By William Rushton, L.D.S.Eng.

Mr. President and Gentlemen,—I am here in response to the request of our Secretary that I would read a paper before this Society. The subject I have chosen is "The Use of Gutta Percha in Conservative Dentistry." It is a subject which has been of considerable interest to me for some time, as I felt that such an excellent tooth-saving material as gutta percha was worthy of more attention than it had received in the past. I also wished to fathom, if possible, the different characteristics and composition of the various preparations offered for our use, and find out in what particulars they differed from each other, and the cause of such difference. Furthermore, I have adapted a method already known to science, for eliminating the undesirable constituents of gutta percha and in making what I venture to think is a filling material of greater stability and durability than any with which I am acquainted. This method I will describe in due course.

Gutta percha probably consists of a hydrocarbon (pure gutta) having the formula $C_{10}H_{16}$; albane, a white resin, $C_{10}H_{16}O$; fluavile, a yellow resin, $C_{40}H_{64}O_3$; and a variable component named guttane. You will notice that the resins have practically the same chemical formula as pure gutta *plus* oxygen. In the crude state it also contains foreign matter such as stones, sawdust, bark, sago-flour, and other substances, owing to impurities entering while it is being collected, or due to wilful adulteration. The factor which makes gutta percha so valuable in commerce is the hydrocarbon "gutta," which, when pure, is a milk-white substance, becoming soft and plastic on heating, and hard and tenacious on cooling, without being the least brittle. The resins are accessory compounds due to oxidation, and they have a decidedly detrimental effect when they exist in too large proportions. It also contains a variable quantity of water.

Gutta percha is chiefly obtained from the tree *Isonandra Gutta* which is distributed over a well-defined area including part of Borneo and the Malay Archipelago, but no less than thirty names have been mentioned of the different plants from which supplies have been obtained, though probably some of these names are synonymous. The quality and quantity of the yield also varies very much, depending upon the age and con-

dition of the tree, the manner in which it is bled, and the season. The best flow is undoubtedly obtained from the felled tree, but this extravagant plan of obtaining the juice is now being abandoned on account of the increasing scarcity of the plant, and bleeding is being resorted to. The yield is, of course, less, but the vitality of the plant is preserved. When we consider that an average tree yields, when felled, about two and a half pounds of gutta percha, and that this fetches, say, 3s. 6d. per pound, it is not surprising that considerable adulteration takes place, not only by the substances already mentioned as being found in fairly good samples, but by what is more deleterious, the juices of other plants.

When the juice is drawn off it loses 35 per cent. of its weight after the first six months. If it is not boiled within a reasonable time oxidation rapidly sets in, and many good samples have been spoilt from this cause. It would seem that, other things being equal, the smaller the percentage of resins (which, as we have seen, are oxidised gutta) the better. Specimens differ very much, the percentage of gutta varying from 31·6 to 84·3 per cent.; resins from 10·7 to 71·5 per cent.; dirt from 1·8 to 5·1 per cent., and water from 1 to 13·4 per cent. Specimens also vary in molecular construction, therefore their physical and mechanical properties and their

durability differ very much. For example, in a sample containing 60 per cent. of resin the softening point was 107·6° F., while that of a sample containing $2\frac{1}{2}$ per cent. of resin the softening point was 131° F. The breaking strain of a sample containing 55 per cent. of resin was 770 lbs. to the square inch, while when the resin was extracted the breaking strain was nearly double that amount. A medium quality sample cleaned in the ordinary way gave the following results with and without resin:—With resin, softening took place at 137·8°, without resin, 195·9°. The time taken to again become hard was, with resin, seventeen minutes, and without resin, three-quarters of a minute. The difference in the tensile strength was five times as powerful as it was before the resin was extracted.[1] These facts seem to prove conclusively that the larger the proportion of pure gutta in the sample, the more valuable are its properties. The appearance of various samples also differs considerably, varying from brown to white. As a rule the whiter the crude gutta percha the more brittle it appears to be.

Gutta percha is insoluble in water, alcohol and dilute acids, and alkalies. It is soluble in

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[1] E. F. A. Obach, Cantor Lecture, *Journal of the Society of Arts*, December, 1897, *et seq.*

chloroform, bisulphide of carbon, light petroleum, ether, and partially in essential oils. Purifying by solution, straining and subsequent evaporation has been abandoned in commerce, because the molecular structure is affected and the tough fibrous character of the substance is partly lost. The best gutta percha is from superior samples obtained directly from the tree. A good sample should be as hard as wood, only just receiving the impression of the thumb nail; when moulded or rolled into sheets it should assume a tough fibrous character. When imported into this country it is in blocks more or less impure. The blocks are first sliced by machinery, and then the residue is placed in troughs of water heated by steam. As soon as the gutta percha becomes soft it is taken out in baskets and placed in a toothed machine which tears it into fragments. These fragments fall into water; the gutta percha floats and impurities sink. The loss or waste during cleaning is sometimes as much as 50 per cent. The mass is then taken out, washed with cold water and dried. It is then heated by steam until soft, and kneaded by machinery into a homogeneous reddish-brown mass. When in this machine various substances can be introduced to vary the hardness, colour or density of the mass. By this means a soft, elastic, or hard horny substance can be produced. When suffi-

ciently masticated the mass is placed while warm between steel cylinders and rolled to the required thickness.

The earliest mention in England of gutta percha occurs in the catalogue of the Museum collected together by the Tradescants, and which afterwards became the nucleus of the famous Ashmolean Museum at Oxford. The entry in the catalogue bears the date 1656, and is as follows: — "The plyable mazer wood, being warmed, will work to any form." "Mazer" is to-day one of the vernacular names of gutta percha, and there is little doubt it was the substance mentioned in the catalogue. Unfortunately the specimen appears to have been lost, as it now can neither be found at the Ashmolean Museum nor at the Botanic Garden at Oxford.

In 1822, Dr. Montgomerie, a surgeon in the service of the Honourable East India Company, having observed gutta percha in Singapore in the form of whips and other objects, made some experiments, and recommended the substance to the notice of the Medical Board in Calcutta as useful for making splints and other surgical apparatus. He sent specimens to the Society of Arts, which body, rightly foreseeing the immense utility of the substance, presented Dr. Montgomerie with its gold medal on his return to England.

According to Professor Foster Flagg,[1] gutta percha was first suggested as a temporary stopping for frail teeth some forty-five years ago. It is certainly not mentioned in the "Course of Lectures on Dental Physiology and Surgery," by John Tomes, published fifty years ago. There is, however, a paragraph in the first edition of his "Dental Surgery," published in 1859, devoted to it. It is there mentioned as "a temporary filling capable of lasting for some months." The first material used was the brown natural gutta percha, the colour of which was objectionable. Then Dr. Hill introduced his stopping in America, and in 1857, Mr. Jacob, in a paper read before this Society, described how he manufactured his gutta percha stopping.[2] Various preparations have since been placed before the profession, and I propose to deal briefly with the composition and characteristics of some which I have used in practice and upon which, in conjunction with Mr. Ord, the chemist, I have conducted experiments. The prepared gutta perchas I have examined are the so-called base-plates made by Messrs. S. S. White and the Gutta Percha Company, Hill's, Jacob's, George Pedley's, and Flagg's High Heat gutta perchas. They are all gutta percha mixed with some

[1] "Plastic Fillings" by J. Foster Flagg.

[2] Transactions of the Odontological Society, vol. i.

mineral constituent to give colour and hardness. Red base-plates contain oxide of zinc and vermilion, Flagg's contains oxide of zinc, Hill's contains oxide of zinc and lime, Jacob's contains silica (one specimen also contains oxide of zinc), Pedley's contains oxide of zinc and kaolin.

When incinerated in a capsule and the residue weighed, the following approximate results are obtained :—

	Per cent. of ash left.
S. S. White's Red base-plate	75
Gutta Percha Co'.s impression base-plate ...	55
Flagg's High Heat	82·5
(According to his formula it is 85 per cent.)	
Hill's	80 to 83·4
Jacob's	20, 15, 33·4 and 57·5
(According to his formula it is 20 per cent.)	
Pedley's	80
(According to his formula it is 77·8 per cent.)	

Pure gutta percha only leaves $\frac{1}{2}$ to 1 per cent. of ash, and this has been ignored in these experiments, which do not pretend to be anything more than fairly approximate. We see therefore that the composition of these materials varies considerably. Jacob's contains the least proportion of foreign admixture when made according to the published formula; Flagg's, Pedley's and Hill's contain about four times as much, and they again vary in their characters, as the two former set much more quickly than Hill's, and are more durable and tougher.

Let us first examine Jacob's stopping. Jacob prepared his gutta percha by pulling the crude material to pieces in hot water until all dirt and accidental impurities were removed. He then dried it and moulded it into little balls which were enclosed in calico and suspended in chloroform, the object of the calico being to retain most of the colouring matter while allowing the chloroform to dissolve the gutta percha. When this was effected the solution was placed in a bottle having a small aperture at the lower end closed with a plug. A little water was then added to the solution and shaken; the water precipitated a small quantity of the gutta percha, which rose to the top carrying any foreign matter with it, while the clear liquid was then drawn off from the bottom. From this liquid the gutta percha was recovered by distilling off the chloroform. The residue was then dried, and after being rolled out on a warm slab was incorporated with 20 per cent. of fine white silica prepared from the fluoride of silicon.

The method of preparing Jacob's stopping is a good one, as time has shown, and by the reputation that this stopping has acquired. But it is open to criticism on two counts: firstly that the gutta percha is purified by solution and recovered by evaporation, which, according to Obach, alters the molecular structure; and secondly, what is

far more important, the resins are not got rid of but still remain. If an excellent sample of gutta percha is used, a very good stopping is the result, but, as we have seen, excellent samples seem to be getting rarer, and the reason seems to be that they contain an increased proportion of resin to gutta. Mr. Ash, in writing to me on the subject says, "We are not acquainted with any article that varies so greatly in its raw state as crude G. P."

Before proceeding any further, I wish to say a few words about the causes which cause gutta percha to deteriorate. The two most important factors are air and light, especially light. When gutta percha is exposed to a continuous current of oxygen it becomes slowly oxidised on the surface and gradually becomes resinified and brittle; ozone, curiously enough, has no such action. This takes place to a greater or less extent when exposed to the air, and still more when exposed to air and light. But this resinification differs very much in various samples, the better class ones seeming to resist this change much better than inferior specimens. For instance, there are two specimens of gutta percha in Kew Museum, which were sent to Sir William Hooker in 1846 and 1847, which are still good. They have been kept in a dark cupboard to which the air had free access. Two specimens taken from one mass, one exposed to light and air and the

other enclosed in tin-foil, were kept for a number of years. The exposed sample was found resinified on the surface, while the protected sample was unchanged. Mr. Ash says, "It is difficult to fix a time when deterioration takes place in gutta percha. Some lots oxidize much more quickly than others; some will keep good for eight or ten years, others will perish in two or three years." This no doubt is due to the quality of the crude article; the more resin it contains to start with, the greater the probability of further resinification taking place.

Having now explained that resinification and deterioration are synonymous terms (nearly synonymous but not quite, as the quality of the gutta in the sample must be taken into consideration), I shall now show the results of our experiments on five samples of Jacob's stopping.

	Percentage of Ash when Incinerated.	Percentage of Resin in Gutta Percha present.	Remarks.
(*a*) Oxidised No. 2 ..	20	53·3	Useless. Brittle when cold, pasty and sticky when heated; hardens slowly.
(*b*) Sample 7 to 10 years old, No. 1	20	40·1	Very fair stopping.
(*c*) Sample dated 7/2/96, No. 1	15	55	Poor stopping; hardens slowly.
(*d*) Sample dated 9/10 95, No. 2	33·4	40·6	Poor stopping; sticky when heated.
(*e*) Sample, recent, No. 1	57·5	26·3	Very fair, but character of stopping different; hardens quickly.

The difference between No. 1 and No. 2 stopping is merely one of colour.

It will be seen that the character of the stopping varies to a great extent with the amount of resin present, though not altogether. For instance, (*c*) is a better stopping than (*a*) although it contains a greater percentage of resin, and (*b*) is better than (*d*) although they contain the same percentage. This is most probably due to the quality of the gutta in the crude article, which varies somewhat. The amount of silica present also modifies the character. The sample (*b*) is remarkable as being in very fair condition after many years. This is no doubt due to its having been made from an excellent gutta percha and to its having been kept in a dark cupboard. The value of stoppings of this class depends on their toughness. The objectionable feature is that they are apt to swell in the cavity after a time. The sample (*e*) is entirely different from Jacob's formula, and closely approaches the character of Flagg's and Pedley's in having a large admixture of mineral constituent. It also differs from the other samples of Jacob's in containing oxide of zinc.

I shall now turn to stoppings of a different character in which the percentage of gutta percha is small, in fact only sufficient to act as an agent to bind particles of mineral constituent together.

The first I shall mention is Flagg's High Heat. This is a mixture of 85 per cent. of oxide of zinc with 15 per cent. of gutta percha. The high temperature to which it must be heated is an objection to its use in teeth which are sensitive to thermal changes. It also sets very rapidly. It does not expand and has good lasting qualities. Toughness is, however, sacrificed by the large admixture of mineral matter, as can be seen by biting.

A very similar preparation is that made from the formula of Mr. George Pedley, which contains about 80 per cent. of mineral matter, oxide of zinc and china clay. It is also a very good stopping of this class, slightly tougher and not so hard as Flagg's. Mr. Pedley says in his book[1] that gutta percha tissue answers well for making it; but theoretically, as tissue presents such a large surface to atmospheric influence, I should think it was inadvisable. As a matter of fact, Mr. Pedley tells me he does not use the tissue himself, but the gutta percha from which the tissue is made. Both these also differ from Jacob's in that the gutta percha is not purified by solution. The powders are gradually added, care being taken not to over-heat the mass. Pedley's preparation is rather too white in colour.

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[1] "Diseases of Children's Teeth," by R. Denison Pedley.

The next stopping we shall consider is Hill's. This contains about as much mineral matter as Flagg's High Heat, but is an entirely different stopping. It softens at a low temperature, remains soft a considerable time, has very little toughness, and wears away quickly. It can only be considered a temporary stopping, in spite of the assertion of its inventor that it was destined to replace gold as a filling material. How it is prepared I cannot say, but the admixture of its constituents oxide of zinc and lime in various proportions to gutta percha, failed to make a preparation similar to Hill's. It may contain some resinous material which reduces its softening point and retards its setting.

Old S. S. White's base-plate gutta percha makes a very good filling. I cannot speak of any recent manufacture, for I have not used any. I used an old sample which belonged to the late Mr. Merryweather, and I was very sorry when it was all gone. I have procured some from the Dental Company which they have had many years in stock, and it works well. I at one time thought that gutta percha improved by keeping (and it possibly may for a while by getting rid of some water), but I now think that the toughness must be due to the good gutta percha of which they were made. The impression gutta percha sent out by Ash's and the

Dental Company contains 20 per cent. less oxide of zinc and is much softer than the S. S. White's, and is too soft and sponge-like to make good stoppings, or to work nicely. Their colour makes these preparations useless for conspicuous cavities.

The characteristics of a good gutta percha stopping, in my opinion, are as follows: firstly, it should be tough, so tough that the canine teeth have considerable difficulty in biting through it; it should be hard enough so that the thumb nail just makes a slight impression on it; it should soften at not higher than 175° F.; it should set in thirty to forty-five seconds. When softened over a flame sufficiently to work it should not feel sticky to the fingers, and until it sets should feel resilient and not pasty when pressed. It should be of a suitable colour.

As regards the preservation of the stopping, it should be kept in a receptacle impervious to light, it should have as small a surface exposed as possible, therefore pellets are objectionable. Most probably sticks wrapped in tin-foil and kept in a box would last indefinitely, pieces being cut off as required.

I shall now give what I think is an improvement on any of the foregoing. Its utility depends upon the elimination of what has been shown to be deleterious in gutta percha, namely, the resin. The resins are soluble in spirit, pure

gutta is not; therefore if we dissolve gutta percha in any of its solvents, and treat the solution with spirit we precipitate pure gutta and get rid of the resin. Pure gutta contains all the good qualities of good gutta percha in an enhanced degree, and therefore if we can utilise this substance to the best advantage we are getting the most we can out of gutta percha. The two qualities in a gutta percha stopping ought to be toughness and hardness. The gutta percha gives us toughness, but it swells; the mineral admixture gives us hardness, but it tends in excess to eliminate the toughness, which, in my opinion, is the best quality of the stopping. Pure gutta is so extremely tough and tenacious that it will bear a considerable admixture of mineral matter, which hardens it and controls the tendency to swell in the mouth, without detriment to the stopping. It is also harder than gutta percha to start with, so that by using the following formula one gets what is, in my opinion, the best of both qualities.

Pure Gutta	50 parts
Finely Levigated Silica	30 ,,
Oxide of Zinc	20 ,,

The gutta should be gradually heated and the powders added in small quantities at a time. I find the best way to use it is to gently warm a portion sufficient to fill the cavity over a flame, then roll it in the fingers to an elongated shape

the diameter of which is less than that of the cavity. Then heat a round-headed burnisher and press it to one end of the cylinder, which will adhere to it. Then gently heat the stopping over the flame, taking care to heat the burnisher as little as possible; carry to the cavity and press home. The round head of the burnisher may easily be detached by rotation. If adhesion to the cavity wall be desired, the stopping must be heated to a higher temperature, or dipped in eucalyptus oil, and the oil then volatilised by heat, leaving a sticky surface. In my opinion gutta percha stoppings should not be trusted to remain by adhesion but by judicious undercuts. To prevent dragging when the filling is being trimmed off, the trimmer should be made fairly hot, the filling being trimmed off towards the cavity-wall. Accurate gauging of the amount of stopping to be used saves much trouble. Oil of eucalyptus or chloroform may be used if necessary to trim the edges.

As I have only recently taken up the subject, I am sorry I cannot report the behaviour of "gutta" stopping in the mouth. All I can say is that it works well, and I feel very sanguine about its wearing qualities. The objection to it is that the preparation of the gutta is a tedious and somewhat expensive process, I believe.

Gutta percha stoppings in actual practice are

divided into temporary and permanent. The former should be easily introduced without pressure, if necessary — easily removable, adhesive, and sufficiently durable to last a few weeks. This variety is useful for filling a partially prepared cavity, or for sealing dressings and drugs in cavities for short periods. Gilbert's preparation is a fair sample of this class, though in my opinion it sets too rapidly. Pedley gives a formula in his book.[1]

The word "permanent" as applied to gutta percha has sometimes been objected to, and to a certain extent justly so; but as far as my experience goes, in certain situations it is probably the most permanent filling we can use. Every filling material has its special advantages and special drawbacks, all of which I shall not stop to enter into. The drawbacks of gutta percha are its inability to maintain much contour; some makes swell in the mouth and overlap the cervical edge, but wear well; some do not swell but wear away. Its great advantage, however, is that it is a splendid tooth saver. I cannot remember having seen a cavity in which a gutta percha stopping was placed—even though much worn down—in which, or round the edges of which, fresh caries had com-

[1] "Diseases of Children's Teeth."

menced. I know of no other filling material to equal it in this respect, excepting perhaps tin-foil. Added to this it keeps a fair and inconspicuous colour, it does not discolour the tooth, it is an excellent non-conductor, it can be easily worked, it can be prepared in any shade of colour, and it is easily tolerated. That it renders the dentine under it more sensitive, as has been stated, I do not find to be the case.

We are all very glad when a patient presents himself with hard teeth capable of receiving a hard filling. But these cases seem to be getting fewer, and the teeth we are called upon so often to treat are the soft bluish-white variety, the carious dentine of which is like sponge, and the enamel like egg-shell. How often do we see fresh caries starting on the margins of cohesive gold fillings in teeth of this nature, especially in the mouths of young people. Amalgams are also at fault, although Professor Black holds out some hope. His formula has yet to be tested thoroughly in the only laboratory worth considering, namely, the mouth. It is well known that at certain periods of life the teeth decay much more quickly than at others. I believe a judicious use of gutta percha in the mouths of young people of the aforesaid type who can be seen regularly, is good practice, besides which it can be allowed to exercise a separating action

preparatory to filling with metal. Suffering is also reduced to a minimum at an age when it is badly borne. In my opinion gutta percha is the conservative filling *par excellence* for weak teeth, temporary teeth, and senile teeth, either used alone or in conjunction with other fillings. In temporary teeth it is easily inserted for the child, durable, well tolerated and easily removable. In the approximal cavities of temporary molars one stopping of permanent gutta percha between the two teeth is of the greatest service, and is more durable than amalgam under similar conditions. The reason is that the amalgam, being absolutely rigid, permits of no play without loosening. Gutta percha, on the other hand, does not become loose, and although it may wear down more or less the teeth are preserved. In the rapid decay of the teeth of elderly persons, gutta percha may be used with the greatest advantage, and bears out its tooth-saving qualities to the full, while the tax upon its wearing qualities is not so great owing to the muscles being feebler.

The most dangerous spot for a filling to fail is the cervical edge, because it is nearest the pulp, it is difficult of observation, it is protected from the force of mastication, and consequently decay may proceed painlessly to dangerous depths. It is also the most usual point of failure

because it is often the most difficult point to fill and trim off, and when under the gum it has no protecting enamel. In such cavities gutta percha is a permanent filling. It is well tolerated, easily inserted, easily removed if devitalisation is necessary, and absolutely preservative. We all know it is excellent practice to protect the cervical edge with gutta percha in cavities at or under the gum in which we place oxy-phosphates. I have lately been trying the same thing with amalgams, being careful to place a thinner film of gutta percha, and allowing part of the amalgam to rest on the dentine. I find Flagg mentions the same practice.[1] I think the danger of the gutta percha being pressed out a remote one, even if the amalgam rested solely on it, but that depends on the gutta percha used and on the force of mastication.

Gutta percha as a material for impression taking does not lie within the scope of this paper. It is useful as a root canal filling and for cementing crowns and pivots. I have found the best material for the latter operation is the impression gutta percha, as it is very tenacious and fairly soft, remaining so for a considerable time. For cementing all-gold crowns I have found a useful plan is to place some impression

[1] "Plastic Fillings," by J. Foster Flagg.

gutta percha in the crown with a few drops of eucalyptus oil, heat and stir gently until some of the oil is driven off and a sticky viscid mass is left; the crown is then pressed into place. Objection has been taken to the use of gutta percha for this purpose as the odour of the crown when removed is very unpleasant, but of this I have had no experience. I can only say that I have found that any stopping, after being in the mouth a long time, evolves an unpleasant odour when heated.

I must now bring my remarks to a close, merely emphasising the fact that where gutta percha stoppings vary so much in their composition, and where the crude gutta percha varies so much in itself, any attempt to standardise the preparation is a move in the right direction. This, I think, has been done by the method I have described, and that a stable preparation containing the good qualities of gutta percha without its bad ones can now be prepared.

I wish to record my grateful thanks to Messrs. Ash, the Dental Manufacturing Company, Mr. Pedley, and Dr. Obach, for specimens and information supplied, and also to Mr. Ord for the skill and patience with which he has conducted the experiments.

Discussion.

The Chairman said it had always occurred to him that gutta percha might be improved upon by the addition of india rubber, which did not oxidise nearly so much. A compound of one part of gutta percha and two parts of india rubber had none of the disadvantages of gutta percha. When the first Atlantic cable was laid the insulation material was of gutta percha, and it oxidised to such an extent that the electricity more or less escaped and the current became weakened. India rubber was then introduced in combination with gutta percha, and that seemed to stand the wear and tear of the water very well. Then, again, he thought that with the addition of some antiseptic, such as hydro-naphthol, the disgusting odour which followed the use of gutta percha was done away with.

Mr. Denison Pedley said that no doubt the members would welcome very heartily any new preparation which bade fair to be better than those they had in hand. The preparation spoken of by Mr. Rushton as being invented by Mr. Denison Pedley was not his own invention, but that of his father. He had already advocated the use of gutta percha fillings, and therefore there was no necessity for him to say more upon that point, but he might mention that the great disadvantage he had always found with regard to gutta percha was not its want of permanency, but its wearing away so rapidly and its change of colour. An interesting point with regard to the preparation of the gutta percha seemed to him to come from the method of preparation. It was very easy to give a formula of two of gutta percha and three of oxide of zinc and four of china clay, and so on, but the whole thing seemed to him to turn on the method of preparation. He had always been under the impression that by dis-

solving gutta percha in chloroform some of the value of the constituents was taken out, but he was very glad to hear from Mr. Rushton that that was not so. He should like to ask Mr. Rushton how after he had precipitated the gutta percha he incorporated it with the materials he advocated. With regard to the permanence of gutta percha, within the last week he had had one patient who had a mesial cavity in a bicuspid which his father filled twenty-three years ago. The stopping was somewhat worn, but it had effectually saved the tooth. Another case was that of a patient who had had a filling in a maxillary incisor tooth which had been stopped by himself when a student some fourteen or fifteen years ago. It had turned dark in colour, and when he saw it he could scarcely believe that it was a gutta percha filling until he began to remove it.

Mr. Baldwin also added his tribute of thanks to Mr. Rushton for his very admirable paper. The gutta percha, which seemed to him to be the best for all round permanent work, as far as it could be made permanent, was the red base-plate gutta percha of S. S. White. It seemed to be the most lasting and to retain its colour very well indeed. Being red it was of course not a natural colour for a tooth, but even in front teeth, if there was a very thin, semi-transparent layer of enamel in front of it, it did not look bad. It did not show dark, and the tooth remained of very respectable appearance. There was something in it which prevented it taking on the brown dirty colour which most of the white gutta perchas took on in time. There was only one objection to the base-plate gutta percha, viz., that it was rather difficult to work. It required rather a high temperature to soften it sufficiently, and it had a tendency to be pulled out by the instrument with which it was packed. Those difficulties could be got over; first, by not using a ball headed burnisher, but an instrument which was practically a very elongated, truncated cone, with a rounded absolute extremity. Another way to make it work easily was to heat it thoroughly until it was perfectly soft, holding it under eucalyptus oil for some ten or twelve seconds until

it was sufficiently cold to insert it in the cavity. At that high heat the eucalyptus oil seemed to percolate into the gutta percha and soften it right through. If it was held longer it would become a slushy mass. There was another way of making it easy to work, and that was by varnishing the cavity first with a solution of ordinary resin in chloroform. Sometimes one met with a stopping which was evidently largely gutta percha, but which did not soften on the application of a hot instrument.

Mr. F. J. Bennett said that with regard to the formulæ that had been stated, the thing which appeared to him rather extraordinary was that there was the greatest possible variety in the amount of mineral matter combined with the gutta perchas, and yet there was not such great variety in the wearing powers of gutta perchas—at least, they did not vary to the extent one would be warranted in thinking from such an amount as 80 per cent. of mineral matter in some cases to none in other gutta perchas. It occurred to him therefore, it was not so much the amount they contained originally as the method of preparation; or it might be that in those which contained a large amount of mineral matter, when used in a mouth which had a tendency to be acid, the mineral matter might be dissolved out of the gutta percha stopping, and so produce a more porous stopping than if the original stopping had been one richer in gutta percha and poorer in salts. Sometimes a gutta percha was obtained which had not much mineral matter and yet was a very good one. There was one objection which had not been stated, which younger practitioners ought to bear in mind, viz., that it sometimes tended to make the teeth irregular. The swelling of the gutta percha might easily twist a lateral or a central out of position.

Mr. Northcroft understood Mr. Rushton to say he was in the habit of setting crowns with the gutta percha that was used for impressions. He should like Mr. Rushton to be good enough to say how he got rid of the surplus that must sometimes occur under the gum, because in his experience impression gutta percha was extremely tough and would be extremely difficult to remove.

The Chairman said that Mr. Bennett's remarks with regard to the soluble additions to gutta percha were important, and he thought that anything added to gutta percha should be insoluble, such as glass or silica. The method he had been experimenting with was using two parts of india rubber and one part gutta percha, and some sulphate of antimony, and practically vulcanising it by using very hot instruments. He had one case where it really became very hard and answered admirably. He used both sulphate of antimony and sulphur, two parts of india rubber and one part of gutta percha. It did not create the pain one might imagine because the gutta percha was non-conducting. Whether that would prove useful still remained to be seen.

Mr. Rushton, in reply, said probably some substance might be found which would not act on gutta percha and disintegrate it in any way, but he had tried no experiments in that direction. With regard to the admixture of gutta percha and india rubber, rubber did not last as well as gutta percha, and he doubted whether it would be a very happy admixture; in addition to which it was much more elastic and resilient, and the difficulty of placing it in the cavity would be very much greater. Mr. Denison Pedley had asked how it was incorporated. It was incorporated simply by warming the pure gutta on a slab and adding the powders in small quantities. With regard to the discolouration of stopping, he thought that gutta percha stopping containing resin would be more likely to discolour than those having simply the hydro-carbon. With regard to eucalyptus, he mentioned in his paper that he found a very good way, when he required adhesion, was to warm the stopping itself, dip it in pure eucalyptus, and warm it again, so as to just volatilise the eucalyptus and get an intensely sticky surface. Mr. Bennett's remarks were very interesting. There were two main sorts of gutta percha stoppings, those containing a large quantity of mineral and those containing a large quantity of gutta percha. The latter swelled and discoloured and the other did not swell but wore away. He thought it wore away by the granules of the mineral being very lightly held together

by the binding gutta percha, and consequently friction abraded them, which, if the stopping were tougher, it would not do. There was no doubt that stoppings did vary in different mouths, and it depended, he believed, largely upon the force of the bite, and to a great extent upon the situation of the cavity. For instance, a cavity at the cervical edge or in the deep cingulum of a child's tooth was practically everlasting. It would be found that as a gutta percha stopping rich in vegetable matter swelled, it would slightly press the teeth apart. Mr. Bennett was perfectly correct in saying it was such a reliable filling. It never gave the trouble osteo gave. With regard to setting crowns with eucalyptus and gutta percha, the crown should be set first of all on a fusible metal model, and the surplus gutta percha pressed out. Mr. Boyd Wallis's idea about vulcanising gutta percha was one which had passed through his mind, but he did not think sufficient heat could be got with burnishers in the mouth to have a vulcanising action on gutta percha or gutta percha and rubber. In conclusion, he thanked the members for the kindness with which they had listened to his paper.

The Society then adjourned until May 2 after the customary votes of thanks had been passed.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING.

May 2, 1898.

Mr. W. E. HARDING, L.D.S.,

President, in the Chair.

The Secretary read the Minutes of the last meeting, which were confirmed.

Mr. Francis Henry Morgan Van-der-Pant, L.D.S.Eng., was balloted for and elected a resident member. Mr. W. B. Woodhouse signed the Obligation Book, and was admitted a member of the Society.

Messrs. Preedy and Barrett were appointed auditors of the accounts.

The Librarian announced that he had received a paper "On the Development of Marsupial and other Tubular Enamels, with Notes upon the Development of Enamel in general," by Charles S. Tomes, M.A. F.R.S., contained in a number of the *Philosophical Transactions of the Royal Society of London*. He also stated that Tomes' "Dental Anatomy," 5th edition, 1898, had been added to the Library. He took the opportunity of intimating that he would be glad to receive any changes of address of members, or additional qualifications for insertion in the list of members, which would be sent out after the Annual Meeting in June.

Mr. Storer Bennett (Curator) said he had been asked to show, but not to announce as a contribution to the

Museum, two mandibles that had been dug up at Highcliff, about four miles from Worthing. There was nothing very remarkable about them except that they were said to be Anglo-Saxon jaws, and to date from about the year 600. The bones and teeth were well developed. They showed a good many *post-mortem* marks of time, the result, he thought, of the lime in the earth in which they were buried. He also exhibited a small supernumerary third molar, which Mr. J. Henry Whatford, of Eastbourne, had extracted from between the second and third maxillary molars. It was a curious, flattened tooth, very small, but had three exceedingly well marked cusps, and was more of the shape of a seal's than a human tooth. Mr. Whatford had also sent two models from a young lady, 17 years of age, showing an entire absence of bicuspids. Whether the bicuspids were in the jaw and had not erupted was not known, as the X-rays had not been used. From the appearance of the jaws it was possible the teeth themselves had never been developed at all. On the right side the second temporary molars were both retained, and it was rather curious that in the mandible the second temporary molar was retained quite low down. One very often found where the second temporary molar was retained beyond its time that it was locked at a lower level than usual by the first permanent molar and first bicuspid ; but in the present case there was no first bicuspid, and the tooth had not come up to the level of the first permanent molar, as commonly occurred, and as had occurred in the maxilla.

Mr. Morton Smale, to whom the Society was so deeply indebted for a great many specimens of comparative dental pathology, had sent a most interesting lion's skull—probably a young lion not quite fully grown. In the maxilla on the left side the canine was missing. but it could be seen from the socket that the tooth was fully developed and erupted to its ordinary extent. On the right side the canine was only just erupted to a very slight extent, about half an inch, and he was curious to understand why that was the case. He therefore cut a window from the outer alveolar plate and removed the tooth. In examining the

Mr. MORTON SMALE'S case of aborted root of upper canine; from a young lion.

nasal fossa it was found that the plate of bone covering the canine tooth was very thin, and the tooth could be seen projecting in places through the bone. Apparently, therefore, for some reason the tooth had been tilted a little inwards towards the nasal fossa, and so what ought to have been the root projected into the fossa. On removing the tooth to examine it he found it presented a most remarkably stunted, aborted condition. The crown apparently had been perfectly developed, and then the tooth appeared to have been dislocated with its base inwards towards the nose. Consequently the mass of soft pulp which ought to have developed a root lost its nourishment. The result was a stunted mass of dentine. It was interesting to notice that those stunted roots were in the lower animals not quite as uncommon as might be imagined, and he therefore exhibited two other specimens taken from monkeys illustrating the same condition. There was one other point of interest with regard to the lion's skull, namely, that the infra-orbital canal was bifurcated on the left side; on the right side it was a single cavity of the ordinary shape and size.

Mr. Storer Bennett exhibited several lantern slides illustrating the formation of the tooth.

Casual Communications.

Mr. W. R. Acland read the following notes on Catarrh of the Antrum. He said:—

It occurred to me that I should like to compare notes with my professional friends upon a certain class of case. I do not know any better method than by giving you my own experiences, and trust to get useful information in the discussion which I hope will follow. In fact, I want very much to hear any experience of similar cases.

I have frequently met with patients suffering from neuralgia in and around the malar prominence during nasal catarrh. It may be that the nasal catarrh is only present on one side, or at least worse on one side than the other. And this, as one would expect, is the one on which

the pain is felt. This pain, which is of a dull heavy character and unaccompanied by surface tenderness, is exacerbated by blowing the nose. It is then very acute for a second or two, gradually dying away to the old dull pain.

Besides the malar pains one has noted flickerings of pain in the temporal region, and most important of all, that a tooth or teeth, or the whole jaw of that side may ache.

I attribute those pains to a catarrhal state of the antral mucous membrane, spreading from the nasal catarrh: and it is here to be noted that this neuralgia seldom begins until the nasal catarrh is well established, or even clearing up. One has only to remember the many nerves in the antral walls passing to the skin and the teeth, to realise the possibility of pain arising in this way, and to understand the effect of alteration in the air pressure induced by blowing the nose.

The mucous membrane of the antrum is largely supplied by one of the posterior dental nerves, and this nerve also gives off branches to the molar teeth. It inosculates with the anterior dental nerve which supplies the bicuspid and incisor teeth. And this latter nerve unites with the posterior nasal nerve from Meckel's ganglion at the apex of the canine root. So there is a large network of nerves intimately associated with the mucous membrane of the antrum.

My earliest notes on neuralgia arising in this way were made on my own case. I had a bad nasal catarrh which seemed most severe on the right side. Towards the later stages I had a thorough bone ache (which seemed to me to exactly map out the right maxilla), and all the teeth were hypersensitive, the funniest thing being that teeth which I had long since lost were apparently aching too. There was also present an altered state of skin sensation over the right eye and right side of the scalp. I think I attributed this to extension of the catarrhal inflammation to the frontal sinus.

Possibly an alternative explanation of these cases, to that suggested by the title of my communication is, that the nasal mucous membrane being swelled the antral opening is closed, or nearly so.

And here I may note as a curious fact, that having examined twelve antra in one dissecting room, I found that four of them had no opening at all. I take this to be rather an exceptional proportion.

I suggest this alternative explanation on these grounds, that such a temporary modification of the air pressure might in itself have such an effect as to cause the foregoing symptoms without having to imagine a catarrhal state of the antrum to explain it.

However, I cannot think this latter explanation so fitting to all symptoms as the first. I can imagine an antral catarrh being the cause of the continuous ache, and it seems easy to imagine such a swelling of the mucous membrane around the antral opening as would make a sort of valve of it, and hence the painful effect of blowing the nose.

The question of treatment is not exactly in our department. Still, I ventured to prescribe in those cases what I had used on myself, viz., a cocaine and menthol spray. The effect of cocaine in reducing catarrhal inflammation is simply wonderful. A few drops of a 5 per cent. solution will make a difference in half a minute in a nostril completely blocked. I may incidentally mention that in my own case I found smoking a great pain reliever.

Mr. H. Lloyd Williams said Mr. Ackland's communication was interesting as describing the spread of inflammation from the nasal mucous membrane to the antrum. As a general rule, dentists looked upon that as a very rare thing. Still in certain cases it occurred, and Mr. Ackland's cases proved that the antrum did sometimes become inflamed through inflammation spreading from the nasal fossa. Did any of Mr. Ackland's cases become chronic? In the cases dentists were called upon to treat it was very often difficult to trace the origin. The only case of acute inflammation of the lining membrane of the antrum that he had to treat was such a serious one that he doubted very much whether there was not some new growth somewhere. It was in a man aged 45, and he wasted rapidly. A colleague examined his nasal fossæ and the sphenoids for

evidence of a new growth but nothing was found, and after a short treatment the patient was sent to the seaside, where he recovered very rapidly. The case was one of catarrh, but after the patient had been under treatment for some three or four days there was some pus, but never any large amount.

Mr. Roughton said that although the antrum was often affected as the result of dental disease, it must be borne in mind that the antral mucosa was continuous with that of the nose, and therefore prone to share in any inflammatory trouble affecting the latter. In an ordinary attack of acute nasal catarrh, pain in the region of the frontal sinuses was not at all uncommon. This was no doubt due to extension of inflammation along the infundibulum. The same thing occurred with the antrum, but pain was not so frequently noticed. This was probably due to the fact that the infundibulum was a long canal and easily obstructed when its lining became swollen, whereas the opening into the antrum, having no appreciable length, would not be so easily blocked.

Mr. Ackland, in reply, said in all his cases he had referred to acute catarrh. The patients came to him because their teeth ached. As a rule in chronic catarrh there was no pain to any extent. In all of his cases, as far as he followed them, they cleared up like an ordinary cold. One could see the truth of Mr. Roughton's remark that the length of the infundibulum would more frequently cause pain in the case of the frontal sinuses than in the case of the antral opening.

Mr. George Thomson exhibited several teeth which had been stopped, which he said he kept in his possession, having found them very useful in explaining to his patients certain details of operating. He also referred to the importance of correct contours, and made references to the condition of the teeth of some of the lower animals. He considered that proximal cavities, if not filled in properly, and contoured so as to restore the natural condition, would not be permanent or satisfactory. He only knew of one permanent and quite satisfactory way to contour a molar or bicuspid, and that was with a cohesive gold filling.

In the absence of Mr. Coleman, the SECRETARY read the following communication by that gentleman, "On a Method of Prolonging Anæsthesia in Operations on the Mouth."

"The matter I have the pleasure of bringing under your notice to-night formed the subject of a paper I recently read before the 'Society of Anæsthetists.' Had there been no Society I should most certainly have sought the privilege of bringing it before the members of this: firstly, because I have been for a very considerable portion of my life so intimately and I may add so agreeably connected with your Society, and secondly, because in the past, for many years, almost all the great advances and improvements in the department of anæsthetics were made known to the profession, generally, through the medium of the Odontological Society.

"I trust it will not be thought that because, at the solicitation of their editors, a description of my appliance and the mode of its application has appeared in several of the medical and dental journals—and I must here state that I hold your esteemed secretary, Mr. Butcher, responsible for its again being brought under your notice—that I unduly estimate the value of what I have introduced. At the same time, I have ground for believing that when the instrument is, as it can be, considerably improved, it will supply a desideratum long felt by myself, as doubtless felt also by most of my professional brethren, viz., the prolongation of anæsthesia, and especially by one so safe as nitrous oxide in operations on the mouth.

"The administration of anæsthetics through the nose is no novelty. I believe the first to try this method was the late Sir B. W. Richardson, who attached a small tube to a chloroform inhaler and inserted one end of the tube into the patient's nostril; this was quite in the early sixties of the present century. I soon adopted his idea, but with a thin metallic instrument with tubes passing into each nostril. We neither of us obtained much advantage from this method until I added to mine an air syringe, and thus forced a mixture of air and chloroform into the nostrils.

This instrument effected its object perfectly in the matter of keeping up the anæsthesia, but it was certainly anything but a safe method. The amount of air introduced was regulated, chiefly, by the thumb of the hand which compressed the air ball, and which more or less covered the orifice of the inhaler, and a very rule-of-thumb process it was. Ether I have also used in a somewhat similar manner, but chiefly in New Zealand, but with nitrous oxide I have only recently met with a success that I considered warranted me in bringing my method before the notice of the profession. My appliance consists of a nose-piece adapted to fit accurately over the base of that organ and which communicates with a very flattened tube, made to rest evenly upon the forehead. To this tube is connected a rubber one of good dimensions which passes over the patient's head and is attached to a very oval-shaped gas bag, a lightly constructed two-way stop-cock and an outlet valve intervening ; the gas bag being connected with the gas bottles in the ordinary manner. I certainly think it would be desirable that the base of the nose-piece should be provided with a rubber air-pad, like the ordinary face-piece, but of a much reduced size, for although that before you fits remarkably well over most noses, still, when firmly pressed upon, it is not comfortable ; also the whole should be constructed of a much lighter material—indeed you will readily perceive upon examination that that portion of the instrument which may be considered original bears the indelible stamp of ' home manufacture.'

" In applying the instrument, the nose-piece having been placed *in situ*, an air-padded face-piece large enough to completely cover both nose-piece and mouth, and having only an outlet valve, is placed upon the face and gas from the bag turned on, the patient in the interim having breathed air through the nose from the opening in the two-way stop-cock. When anæsthesia is fully established the face-piece is removed and the operation proceeded with, whilst by slightly distending the bag beyond its ordinary capacity the patient cannot avoid continuing the inhalation of nitrous oxide. Through the kindness of Dr. Buxton, Dr. Hewitt

and Mr. Paterson, who was recently one of the anæsthetists at St. Bartholomew's, a number of experiments have been carried out for me, and the last mentioned has kindly furnished me with the following short report of fifteen administrations. He says:—

"'I have used your apparatus in fifteen dental cases, the following being the durations of anæsthesia:—

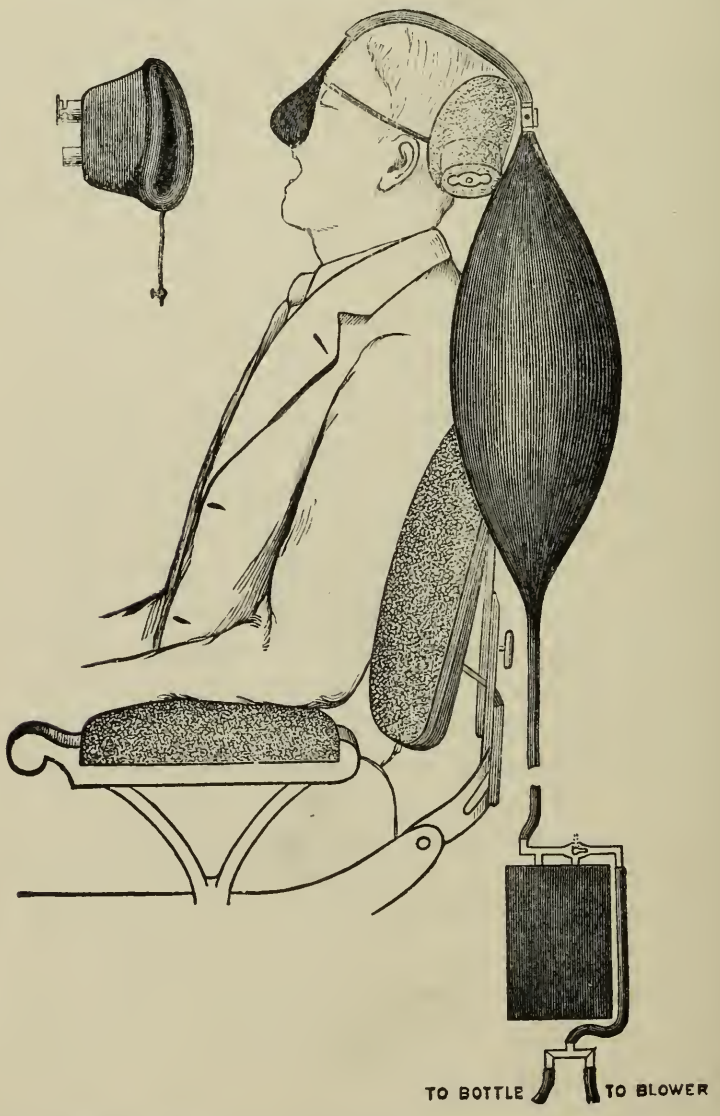
	MINS.	SECS.		MINS.	SECS.
Case No. 1 ...	4	0	Case No. 9 ...	3	40
,, ,, 2 ...	2	50	,, ,, 10 ...	1	20
,, ,, 3 ...	4	0	,, ,, 11 ...	0	50
,, ,, 4 ...	1	50	,, ,, 12 ...	3	40
,, ,, 5 ...	1	40	,, ,, 13 ...	5	0
,, ,, 6 ...	1	30	,, ,, 14 ...	3	10
,, ,, 7 ...	1	10	,, ,, 15 ...	1	10
,, ,, 8 ...	1	30			

"'In all these cases the administration could, I believe, have been continued for a longer period had it been required. The longest case was exactly five minutes, and during this time thirteen teeth were removed, several of them difficult extractions.

"'(Signed) HERBERT J. PATERSON.'

"In administering gas and ether and air through the same nose-piece I use much the same ether apparatus that I employed for many years at the Dental Hospital for giving gas and ether only, but now, besides the gas bottle, I have connected with it a 'Fletcher's foot blower.' I first give the patient nitrous oxide, and when rendered partially unconscious, divert the flow of gas through the ether, and when narcosis is fully established and the operation about to be commenced, turn off the gas and pump air by the foot bellows through the ether, and thus continue the anæsthesia by air and ether alone, effecting of course a very large saving of gas, which my friend Mr. Paterson informs me was very considerable in the cases named in his report. During my experiments with the ether arrangement I was led to try, with a modification of that instrument, a plan for administering chloroform in absolutely definite per-

centages of admixture with air, on the plan of our late esteemed Mr. Clover, but with a far less cumbrous apparatus than he employed. I do not see any insuperable difficulty in carrying out this object, but it is a matter that will involve some time and labour before such an arrangement is rendered perfectly reliable."



The PRESIDENT said that he remembered Mr. Coleman was very much interested in the administration of anæsthetics through the nose in the old days in Soho Square.

Dr. Hewitt said he had come to the meeting to learn rather than to take part in any discussion. He could not but congratulate the Society on having received a paper from so eminent a member as Mr. Coleman, and he thought that Mr. Coleman's energies had been very well directed in endeavouring to prolong the anæsthesia of nitrous oxide. Mr. Coleman brought his apparatus to the Dental Hospital, but it was not then in such a perfect state as it was at the present moment. It was, however, quite obvious to all those who saw his administrations that he was able to prolong the anæsthesia very considerably. He did not wish in the slightest degree to throw cold water upon Mr. Coleman's endeavours, but it seemed to him, if he might say so, that the chief objection to the system was that in a certain percentage of patients there was partial or complete nasal obstruction. If it were certain that a patient had no nasal obstruction, then it appeared to him that the plan of Mr. Coleman had much to recommend it. Mr. Paterson's figures were exceedingly interesting. To obtain an anæsthesia of five minutes by the method spoke very well for it. One would rather have liked to know what kind of anæsthesia was produced—whether the patients were perfectly quiet during the time, or whether there was some movement in the chair. It must be borne in mind that during the last ten or fifteen years our ideas as to what anæsthesia should be had been somewhat modified. Operators now-a-days expected their patients to be absolutely immobile, and very properly so. He did not say that that condition could always be brought about; but at the same time, if the method of Mr. Coleman could not provide the usual immobility on the part of the patient, the method could hardly be considered very satisfactory. It was well known that nitrous oxide was exceedingly safe, and if the new plan could be so improved that it could be depended upon, a considerable step would have been gained. It seemed to him that in using a nose-piece one ought to be exceedingly careful to have it properly washed between each administration. In the case of a face-piece this was not so necessary, because the pad of the face-piece was adapted to the cheeks, and

was a considerable distance away from the lips and nasal orifices. But in the case of a little pad, such as had been mentioned, which must come very near the nostrils, it was important that that contingency should be provided for. If these points were borne in mind, and patients could be obtained whose nasal passages were free, there was a distinct future for the method.

Dr. Silk said that he was in very much the same position as Dr. Hewitt, as he had come to sit at the feet of Gamaliel, and not to take part in the discussion or to make any suggestions. He was, indeed, in a worse position than Dr. Hewitt, having had no practical experience of the plan suggested by Mr. Coleman. There were, however, one or two points which struck him. The proposal of Mr. Coleman seemed to involve two principles; in the first place, the principle of the possibility of prolonging the anæsthesia by means of nitrous oxide, and in the second place, the principle of the introduction of that nitrous oxide through the nasal passages. With regard to the possibility of prolonging nitrous oxide anæsthesia, that had been one of the things which all anæsthetists had been more or less inclined to aim at; as far back as 1848, Dr. Bigelow in America had excised a breast under its influence. Dr. Hewitt, with his usual modesty, had not put forward his own claim to success in this particular direction when he introduced the admixture of oxygen and nitrous oxide. The proposal to use nitrous oxide by itself, or mixed with air, was one fraught with a great many difficulties, and he thought that Mr. Coleman's apparatus had indicated the possibility of success. In the first place, there were the difficulties with regard to the nose-piece, and the frequency with which nose breathing was absent in patients. Then again, from an operator's point of view the arrangement of the bag, as depicted in the figure, was a little awkward in connection with the dental chair; these perhaps were minor points, which a little mechanical ingenuity would soon overcome. Other propositions had been made with a view to prolonging nitrous oxide anæsthesia, one being to put a nasal tube down the nose and convey the nitrous oxide to the back of

the throat. Anybody who had much experience would know, he thought, that it was not always easy to pass a tube of any size through the nose; it frequently gave rise to bleeding, and so rather embarrassed the operator. Another proposition was to put a tube at the back of the tongue towards the epiglottis, or over the epiglottis. With all these propositions there was one difficulty which seemed a very great one, and that was the difficulty in giving a sufficient percentage of the nitrous oxide. If it were given through the nose, the mouth was open, and therefore it became very difficult to maintain anæsthesia when the nitrous oxide was so freely mixed with air. Another difficulty which struck him was that the tube must be attached to a bag, or to some form of apparatus by which the nitrous oxide might be warmed. Nitrous oxide from a bottle of condensed gas was intensely cold, and he would be a bold man who continued a stream of intensely cold nitrous oxide direct on to the glottis and the surrounding structures for any length of time. With the second bag this might be to some extent obviated, but there was, as Mr. Coleman himself admitted, some question as to whether his arrangement might not be improved upon. As to the principle itself, there could be no doubt that it was a good one, and that Mr. Coleman had done a great deal towards making the plan feasible, practicable, and of considerable utility.

Mr. Russell Barrett said he was present at the experiments that Dr. Buxton made, and they were extremely successful. Very long anæsthesias were obtained, but some of the patients were rather troublesome towards the end. If he remembered rightly, Dr. Buxton did not do exactly as Mr. Coleman suggested, that was, give the anæsthetic entirely through the nose. He anæsthetised the patient with nitrous oxide in the ordinary way, with the ordinary face-piece, and immediately held the nose-piece over and kept up the anæsthesia with considerable pressure in the bag, which he controlled with his hand.

Mr. Paterson said he was the operator in the fifteen cases quoted in the report of his namesake at St. Bartholomew's Hospital. There was no doubt in his mind, that the

apparatus had very great advantages, and that anæsthetists would in the future be compelled to adopt some such system in prolonging anæsthesia for difficult dental cases. In the list quoted, the times were those occupied for the particular operations in hand. The longest, viz., of five minutes, was a case in which several teeth and roots were taken out—thirteen, in point of fact. It was a difficult case, inasmuch as he had to split a maxillary molar and take its roots out separately; sponges to arrest hæmorrhage had also to be used, and so prolonged the time of the operation. The first case at St. Bartholomew's in which the nose apparatus was tried was a case very similar to the one Mr. Barrett had described, namely, the ordinary face-piece was first put on and "gas" administered for a time, when it was taken off and the nose-piece applied. That case was an utter failure as far as the prolongation of anæsthesia was concerned. In the second case the nose-piece was tried alone, with the ordinary face-piece covering it. That case was, comparatively speaking, a failure also. It was then discovered that they were trying to anæsthetise people who could not breathe properly through their noses. The next case was a woman who was a splendid nose-breather, and the rapid way she went off and the way she lasted for a simple tooth extraction was remarkable. From that time he began to believe in the apparatus. Then the cases were chosen, and the method employed only when there was free breathing through the nasal passages. All the cases in the quoted list were in this manner selected cases. The other cases to which he has just referred had probably been left out of the report as valueless. There was no doubt in his mind, and he thought there would be no doubt in the mind of anybody who tried the method in a suitable case, of its great value in prolonging the period of anæsthesia. It was surprising to one who had been used to operating under nitrous oxide, as ordinarily given, to find that one could go on doing work for an apparently unlimited period of time. He had had no case amongst those quoted in which he had not been able to do absolutely all that he wanted to before the patient came round. With regard to

the apparatus itself, it was cumbersome, and at first rolled off the head. At St. Bartholomew's they rigged up the hand rest of the chair to form an upright post and twisted a piece of copper wire round it to hold the tube, &c., as in a fork. The weight of the apparatus was another drawback. It might be lightened if aluminium were used, and some method of supporting the bag and tubing at the back of the chair by means of a portable stand, or a table, or other arrangement were adopted. With regard to the nose-piece, it was at present heavy, uncleanly, and a bad fit. He quite agreed with Mr. Coleman that there should be an air-pad to ensure a closer fit, and if the framework could be made of some light and easily cleaned material it would be an advantage. There was a little difficulty in operating in the upper incisor region with the present nose-piece—in fact it could not be done if the patient had a short upper lip. In one of the cases he had to deal with, the nose-piece had to be taken off in order to allow of the extraction of incisor roots being carried out. Otherwise, as far as the principle of the method went, and as far as the length of anæsthesia was concerned, there was no doubt in his mind that it was a valuable means and had come to stay.

Mr. Badcock asked if any after effects followed the prolonged application of anæsthesia.

Mr. Paterson said he had seen none, but it must be recollected that they were dealing with hospital patients, who were in most instances quite unaccustomed to anæsthetics, and who were not so particular as private patients.

The President having thanked the readers of the various communications, and also the gentlemen who had taken part in the discussion, and the donors and contributors to the Library and Museum, adjourned the meeting to June 6, which is to be the annual meeting.

FREDERICK CANTON, M.R.C.S.Eng., L.R.C.P.Lond., L.S.A., L.D.S.Eng.,

President 1894—1895.

Odontological Society of Great Britain.

ORDINARY MONTHLY MEETING

June 6, 1898.

Mr. W. E. HARDING, L.D.S.,

President, in the Chair.

The Annual Meeting of the Society was held at the rooms of the Society on Monday, June 6, 1898.

Mr. W. E. Harding (President) in the Chair.

The Minutes of the last meeting were read and confirmed, and Mr. F. J. Vanderpant signed the Obligation Book and was admitted a member of the Society.

The following members recommended by the present Council as officers and councillors for the year 1898-9 were balloted for and unanimously elected:—President, John Fairbank; Vice-Presidents, John Ackery, C. West and W. A. Maggs (resident); Malcolm Macgregor (Edinburgh), W. A. Hunt (Yeovil) and J. H. Whatford (Eastbourne) (non-resident); W. H. Woodruff (Treasurer); H. Baldwin (Librarian); Storer Bennett (Curator); J. F. Colyer (Editor of Transactions). Hon. Secretaries: J. H. Mummery (Foreign), J. O. Butcher (Council) and H. Lloyd Williams (Society). Councillors (resident): H. L. Albert, H. J. Kluht, A. E. C. Woodhouse, J. H. Badcock, G. W. Bateman, C. F. Rilot, L. Matheson,

E. Lloyd-Williams and W. J. England. Non-resident: E. N. Washbourne (Ripon), J. S. Amoore (Edinburgh), W. R. Ackland (Bristol), A. A. Matthews (Bradford), Morgan Hughes (Croydon), J. A. Fothergill (Darlington), Walter Harrison (Brighton), Alexander Kirby (Bedford) and Henry Martin.

The Librarian (Mr. W. A. Maggs) announced the following donation from Messrs. C. Ash & Sons, "Mechanical Practice in Dentistry," by W. Booth Pearsall, F.R.C.S.I. He also announced the receipt of *The Transactions of the American Dental Association*, and The Transactions of the Odontological Society of Great Britain, No. 2, Vol. XXV., and No. 3, Vol. XXVI., from the President, to complete a set of the Transactions to be kept for reference in the Museum.

The Librarian next presented his Annual Report. He said that thirty-eight members and eight visitors had made use of the library during the past year, ending on May 31, as compared with forty-three and fifteen respectively for the preceding year. The numbers of books borrowed—a privilege now enjoyed by members only—during the year was sixty, as compared with fifty-seven for the preceding year. Many donations and additions to the library had been made, as were announced at the monthly meetings. The exchange list of the Transactions of the Society had been slightly increased, and it now comprised the following transactions, proceedings, periodicals and journals:—*Bristol Medico-Chirurgical Journal, British Dental Association Journal, British Journal of Dental Science, British Medical Journal, Clinical Society Transactions, Dental Hospital of London Transactions of Students' Society, Dental Record, Dominion Dental Journal, German Odontological Society Transactions, Guy's Hospital Gazette, Guy's Hospital Reports, International Dental Journal, The Lancet, Manchester Odontological Society Transactions, Medical Society of London Transactions, National Dental Hospital Transactions of Students' Society, New York Odontological Society, Royal Dublin Society Proceedings, Royal Institution of Great Britain Proceedings, Royal Medical and Chirurgical Society*

Transactions, Royal Society of London Transactions, Smithsonian Institute Transactions, and *West London Medical Journal.*

The TRANSACTIONS had been presented to the libraries of the Royal College of Physicians and Surgeons and to the University of Berlin.

The Society had continued to subscribe for the *Dental Cosmos, Journal of Anatomy and Physiology, Journal of Pathology and Bacteriology.*

The following periodicals were sent gratuitously, and were acknowledged with thanks:—*Chicago Dental Review, Journal of the Pharmaceutical Society.*

The library had been open for the convenience of members and visitors on Mondays and Fridays from 6.45 p.m. to 8.45 p.m., as had been the rule for some years past, and the sub-librarian had been in constant attendance upon those evenings. The Librarian concluded his report by expressing a hope that the library, which contained one of the best collections of dental works and current literature in the world, would be more used for reference purposes and for the loan of books; and he reminded the members that a recommendation book for new works was always at their disposal.

The TREASURER (Mr. Woodruff) also presented the Balance Sheet for the accounts of the Society for the year ending October 31, 1897. (For balance sheet see over page.)

Mr. F. CANTON said the amount which was put down for insurance seemed very small, and asked whether that included the specimens in the Museum.

The TREASURER said he could not say at the moment, but he would make it his business to find out.

Mr. W. A. MAGGS said that some four or five years ago the matter engaged the attention of the Council, and the insurance was considerably increased, and was made to include such items as the insurance of the portraits of past Presidents, and a year's rental in case of fire. The full details would be found in the Minutes of the Council.

On the motion of Mr. F. J. BENNETT, seconded by Mr. BETTS, the accounts were adopted.

The CURATOR (Mr. Storer Bennett) said the President

The Accounts of the Odontological Society for the Year Ended October 31st, 1897.

Cash Account.

Dr.		£	s.	d.	£	s.	d.
To Balance at Bank, as at November 1st, 1896			84	12	0		
,, ,, Petty Cash, November 1st, 1896			5	5	0		
						89	17	0
,, Annual Subscriptions for current year and in advance		470	7	0			
,, Less, Subscriptions Paid Twice and Returned		3	3	0			
		467	4	0			
,, Annual Subscriptions, Arrears		53	11	0			
					520	15	0
,, Entrance Fees					39	18	0
,, Sale of Transactions					4	7	0
,, Interest on Investments					117	8	9
					£772	5	9

Cr.		£	s.	d.	£	s.	d.
By Rent, 1 year					150	0	0
,, Fire Insurance, 1 year					3	7	3
,, Meetings.	Baker—Hire of Microscopes, &c.	3	5	6			
	Reed & Sons—Reporting	18	7	6			
	Postages	20	10	0			
	Camps—Refreshments, &c.	17	10	3			
					59	13	3
,, Library.	Periodicals	2	1	0			
	Thomas—Sub-Librarian	11	5	4			
	Thomas—Binding, Letter Case, &c.	6	11	2			
					19	17	6
,, Museum.	Ebbs—Attendance	13	17	0			
	Curator's Petty Cash Disbursements	7	18	0			
					21	15	0
,, Transactions.	Bale & Sons—Printing	129	0	8			
	Swan—Engraving Blocks and Prints	2	11	3			
					131	11	11
,, Sundries.	Bale & Sons—Printing Notices, Stationery, &c.	54	12	8			
	Brown, H., & Son—Accountants	10	10	0			
	Camps—Honorarium	10	10	0			
	Restoring Portraits, Framing, &c.	10	19	0			
	Banker's Interest on Loan and Charges	2	10	3			
	Broker's Charges on Investments	0	10	0			
	Electric Light Repairs and Clock Repairs	1	16	10			
	Advertisement	1	1	0	92	9	9
					478	14	8
,, Loan from Bank Repaid					150	0	0
,, 2¾ % Consols purchased					116	18	9
,, Cash at Bank, October 31st, 1897		5	12	2			
,, ,, in hand ,,		18	18	0			
,, ,, (Petty Cash) ,,		2	2	2			
					26	12	4
					£772	5	9

Odontological Society's Accounts for 1896-97—*continued*.

Income and Expenditure Account.

	£	s.	d.
To Expenses as per Cash account above	478	14	8
,, Balance, Surplus on the year	203	14	1
	£682	8	9

	£	s.	d.
By Subscriptions as per Cash account above	520	15	0
,, Entrance Fees, ditto	39	18	0
,, By Sales of Transactions, ditto	4	7	0
,, Interest on Investments	117	8	9
	£682	8	9

Liabilities.

	£	s.	d.
To Accumulated Fund, as at October 31st, 1896	4,255	3	4
,, Surplus on year brought down	203	14	1
	£4,458	17	5

Assets.

	£	s.	d.
By 2¾ % Consols, value £4483 1 6 bought at	4,432	5	1
,, Cash at Bank and in hand as above	26	12	4
	£4,458	17	5

Examined and found correct by

RUSSELL BARRETT,
EDWARD PREEDY.

We have written up the above accounts from the books and receipts of the Odontological Society, and certify the same to be correct. We have seen the Vouchers for the amount invested.

May 16th, 1898.

J. W. BUTCHER & Co., *Chartered Accountants*,
18, Bishop's Road, Paddington, W.

had been good enough that night to present to the Society a number of old pieces of mechanical work which year by year were becoming scarcer, and as Museum specimens and objects to be studied were exceedingly valuable. He commended the action of the President to all who possessed specimens of the old work, especially old bone work, or any other kind having natural teeth mounted on the plates, or very early examples of mineral teeth. One of the specimens presented by the President was particularly interesting, as showing very early mineral teeth mounted, not with the ordinary pins such as were employed nowadays, but with strips of platinum inserted in the substance of the mineral body, the strips being employed for the purpose of soldering to the teeth in the ordinary manner. Such things showed stages in the evolution of the manufacture of mineral teeth, and were especially interesting to any who might be trying to trace the history of such things. Mr. Morton Smale had sent a model taken from a patient who, at the age of 16, had two right mandibular molars extracted. In a letter written by Mr. Smale he said " the teeth were extracted because they were decayed and painful. It was possible, however, that the presence of the two supernumerary teeth, which were erupted immediately behind the second right mandibular bicuspids, in the substance of the mandible might have made the operation necessary. The position of the teeth was interesting, as was also the fact that they did not erupt until after extraction of the molars. The model gave support to the accepted view that teeth germs arose *de novo* from the epiblastic laminæ." A case came to the Dental Hospital about four years ago where a woman had a somewhat similar tooth, one close up against the posterior surface of the second bicuspid on the right side, and the other immediately in front of the left second molar. There was no first molar present on either side. Mr. Bennett mentioned that he was also fortunate enough to secure for the Museum a specimen that was intended to gravitate to another one. He thought it would be far more valuable in the possession of the Odontological Society than it would be elsewhere, and there-

fore he induced the gentleman who owned it to make them a present of it, and their thanks were due to him for his generosity. It was a specimen presented by Mr. Apperley, one of the students of the Dental Hospital, of a second right maxillary molar with a second bicuspid lying horizontally, with its roots between the roots of the second molar, the crown being directed forward, and lying in contact with the back of the root of the first bicuspid. The pressure of the tooth against the root of the developing and non-erupted first bicuspid had given it a somewhat bayonet-shaped appearance. Specimens of molars and bicuspids united by a false gemmination had often been seen, but he had never seen a specimen united in this way. The patient came with profuse suppuration, and the house-surgeon attempted to remove what he expected to be the first molar and brought away with it the second bicuspid attached. The first bicuspid being very loose he removed that also, and found the position to be as shown.

Mr. Bennett also presented his Annual Report. He had placed on the table all the specimens presented during the year, and in addition showed some of malformed and damaged tusks, that were exceedingly interesting to those who were studying the subject of inflammation of the dental pulp. He urged any member of the Society who came across such specimens, either in the hands of ivory dealers or others, acquiring them for the Society, and he was quite sure the Society would be willing to purchase them for any moderate sum. They were exceedingly valuable in adding to the series of comparative dental pathology. The Museum now contained a series which no other museum in the world possessed, and year by year that series was growing. The members had a number of friends who were sportsmen, and who, from time to time, came across cases of hares and rabbits that had suffered damage from unskilful shooting or from traps, and he urged members to keep their eyes open to acquire such cases, which were always interesting and valuable. He also suggested that they should interest any sportsmen of their acquaintance going abroad to obtain specimens from the various countries they visited. The

actual number of specimens presented during the year was twenty-five, but though small in number, they were very valuable. With regard to attendance, he was afraid the members did not take much interest in the Museum, for during the twelve months only seven members had signed their names. It was not, however, an extravagant and futile work keeping the Museum open, because of visitors there had been seventy-seven, and that was a very large growth on attendance in bygone years.

Mr. BRUNTON asked Mr. Bennett if he possessed in the Museum any specimens of Japanese dental work. He had one at home which he should be very glad to present to the Society.

The CURATOR said they had one specimen made of wood, as Mr. Brunton informed him was the usual way, but at the same time, as such specimens were rare and very interesting, he should be delighted to welcome the second specimen to the collection.

ALTERATION OF BYE-LAWS.

The PRESIDENT read the Bye-law under which alterations of Bye-laws could be made, and stated that the amendment to be proposed had been brought before the Council and approved.

Mr. W. H. WOODRUFF then moved "That Bye-laws xxxii. and xxxiii. should be altered to read as follows:—

Bye-law XXXII. The President and Secretary, and two Members of the Society chosen by ballot or nominated by the President at the Annual Meeting of the Society, shall audit the accounts of the Treasurer to the end of the financial year.

Bye-law XXXIII. They shall make a written report to the Society, not later then the January Meeting following, regarding the state of the funds, and shall answer any questions relating thereto that may be put by the Meeting.

He thought the alterations would expedite business and that it would be more agreeable to the members of the Society to have the accounts presented nearer to the end of the financial year.

Mr. Badcock seconded the motion.

The President explained that the alteration was simply one making the audit of the accounts nearer to the end of the financial year than it was at the present time.

Mr. Canton said that some time ago there was a talk about altering the financial year itself, and making it coincide with the year of the meeting. He did not know whether that point had been discussed by the Council.

Mr. Robbins said it was under discussion when the Presidential year was changed, but it was found that the difficulties were so great in connection with changing the financial year that it was thought better not to make any alteration.

The motion for the alteration of the Bye-laws was unanimously agreed to.

Messrs. David Hepburn and F. Canton were elected auditors for the ensuing year.

The following papers were read :—On Amalgam, by Mr. W. R. Humby; Further Notes on the Bacteriology of the Mouth, by Mr. Kenneth W. Goadby.

Amalgam.

By Mr. W. R. Humby.

Mr. President and Gentlemen,—For any one engaged in active practice the work of investigating such a vast subject as amalgams must necessarily be fragmentary.

Often, I fear, results obtained are not recorded by dentists; the seeming triviality of such results, and the fear of ridicule deters men who might help.

The value of individual efforts is thus discounted. When their value is overwhelming, as were Mr. Black's, all restraints vanish, and we are astonished that this wealth of information, the accumulation of forty years' careful work, is placed at our service in so liberal a spirit.

It seems to me that there are three ways of trying to obtain what we require.

(1) To simply allow the commercial classes to continue to exploit our requirements, and to profess to be able to supply our wants, as in the past.

(2) To trust to the isolated efforts of men in active practice.

(3) That research should be undertaken by united action, with every requisite at hand—a laboratory equipped with metallurgical, physical, and chemical apparatus, and knowledge—so that if there exists in nature elements suitable for our purposes, such elements may be found. The first and second plans to my mind are objectionable, the more rational course and that which would promise sounder results being the third.

Is amalgam necessary? I think so, in the absence of an insoluble cement. Amalgams are, with a single exception, so far as I know, insoluble, and stand the wear and tear of the bite. If an amalgam, in hardening, underwent no serious change of form, and retained a desirable colour, we should be able to avoid the excessively tiresome operations of gold fillings, which cannot be said to resemble the tooth, and are only used because the yellow of the gold is nearer to the more or less yellow tone of the tooth than are the greys or blacks associated with amalgams.

Nineteen-twentieths of the fillings inserted are plastics, either cement alone, or amalgam alone, or the two combined. Now the first, from its solubility, is clearly useless for permanent work. The second class of fillings is objection-

able; some stain the tooth, all conduct heat and lack adhesive attachment to the tooth substance. Amalgam by itself is being discarded in favour of cement linings with insoluble, unwearable amalgams as external coverings.

When cement was first used as a lining it seemed to control the amalgam plug, preventing the alterations in shape; although a minute change might be detected in an uncemented plug, little or no alteration was to be seen where cement had been used in the average case. In some of the larger plugs the power of the cement to control shrinkage or expansion was not enough, however, and I have had plugs loosened from their cement attachment, and have seen tooth walls broken down where two-thirds or so of the tooth had been restored by cement and amalgam. This fact, together with the objectionable colour of the amalgam used, induced me to interest myself in the question, and besides other materials, I obtained a chemical balance, a micrometer, and made a steel matrix in which to form the plugs to be tested.

Other matters diverted my attention from the subject, and, although I felt very strongly the need of improvement in my amalgam fillings, I put the matter off. Mr. Black's papers were published, and I was ready to test some of his conclusions.

The substitution of maturation by heat for the maturation previously effected by ageing was found to secure uniform tests, abolishing progressive shrinkage.

It is now possible to weigh, melt, reduce to filings and test within a few hours, and know that the same filings tested at any future period will give similar results. Until the cause of uncertainty was discovered, progress was absolutely out of the question. Thus Mr. Black has made and published the very first discovery of any real value relating to the amalgam question.

Mr. Black gives the formulæ for two alloys which he says neither expand nor contract. I selected these for examination :—

No. 1.	Silver, 68½	Tin, 25½	Gold, 4
	Zinc, 1	Bismuth, 1	
No. 2.	Silver, 68½	Tin, 25½	Gold, 5
	Zinc, 1		

Although weighing was easy, melting was more difficult owing to the lower melting metals burning. After many plans had been tried I succeeded in reducing the total loss to 3.4 grains on a two thousand grain melt. I hope to be able to reduce the loss still further.

The method I adopted was to melt the lower metals under gas engine oil, stirring with wood until the metals were reduced to a fluid state;

remove the button, wash, dry and weigh, when I found that no loss in weight had occurred. The gold and silver were melted in a salamander crucible fitted with an asbestos lid to prevent the flux ejecting the grains of metal during the spitting which precedes the fusion of the flux. When the metals were melted more flux was added until one inch deep over the surface of the metal. The heat was shut off and the melt stirred with a carbon point. While the metal was still melted, the button of tin, &c., was lowered through the flux into the crucible. A small blue flame as of burning zinc was visible and thus the loss of weight occurred.

If the baser metals are allowed to enter the crucible at the melting point of the silver and gold before being reduced to a button, an explosion follows, and, on such occasions, I have lost as much as 10 grains in 2,000 or $\frac{1}{2}$ per cent.

Owing to the expense and delay of determining the nature of the loss by quantitative assay, I have deemed it better to try and exclude loss, if possible, altogether. So much for melting. The button removed, cleansed, dried and weighed, the alloy is reduced by filing to a fine state of division, the particles of steel being removed with a magnet. Mr. Black recommends sifting; this I did not at first see the need of, but I intend sifting the filings, in future, not to secure

uniformity in the filings, but to remove foreign substances which do intrude somehow.

Next, as to annealing. To do this the filings are placed in a test tube and boiled for fifteen minutes in a steriliser; when cool, the filings may be mixed with mercury, for use in the mouth or for a test plug. In making my tests I weigh 70 grains of filings and add mercury until the amalgam is of a suitable consistency such as would be used in making a plug for the mouth.

Owing to the large size of the mix, the first incorporation is done by shaking in a test-tube. Mr. Black says the quantity of mercury does not influence the shrinkage or expansion, but does seriously influence the strength of the plug. The packing into the mould should resemble the making of a plug for the mouth. In both cases the softer amalgam works to the surface; it is removed and replaced by dryer, until when the surface is pretty hard, it is smoothed off level, the matrix opened, the plug placed in the micrometer, and about three or four minutes allowed for equalising the temperature of the micrometer and the plug. The time is then taken and the position of the needle recorded. I usually record the movements for one hour at intervals of a quarter of an hour, then set it aside and record after a lapse of twelve hours or so. I have kept a plug in the micrometer for three weeks, but in

the case of Black's Nos. 1 and 2 formulæ, after the initial changes (first contraction, followed by expansion) which were over within the first hour, I could not detect the slightest alteration.

The matrix you can see for yourselves. I made it a mathematical inch in length, under the belief that I should use a micrometer marked to the ten-thousandths of an inch, but I could only obtain one marked to thousandths, except by special order, so to prevent delay I use the one you see, which is marked to thousandths of the inch and to the hundredths of a millimetre. I use divisions of the micrometer scale as ruled to the hundredths of a millimetre as points and add on any excess as a half, third or quarter, as the case may be. I have ordered an instrument marked to ten-thousandths. I do not quite understand Mr. Black's matrices, which seem to consist of steel tubes of a given length into which the amalgam is packed, the plug remaining in the tube until the test is completed. This tends to control the movements, not allowing the actual natural fluctuations to be recorded, so that in point of delicacy his test results in showing no movement on a ten-thousandths scale, while mine has shown quite appreciable changes on a scale a fourth as fine.

As I cannot replace my plugs in the micrometer after removal without some change in

position, I keep the plug in place until I believe all the changes have occurred. In order to appreciate fully the differences in the various alloys in use, I have made some tests to show the magnitude of some of the alterations, which no amount of cementing into the tooth will control.

There still remain many matters which I have purposely omitted in order to keep this communication within reasonable limits.

I will only detain you with two; first, the need, especially in large cavities, of keeping the tooth wet during the shaping of the cavity, and only drying the surface just prior to the insertion of the filling. The shrinkage of a lower bicuspid of a lad aged 14 was, lengthwise, four points—from a state of normal wetness to that of perfect dryness. Thus by drying the tooth substance throughout its coronal portion, we are contributing to an inevitable alteration of form when the tooth regains its normal volume.

Second, as to colour. This I cannot certify to, as there is only one reliable test, that is, in the mouth, after an extended trial in practice; but I have been, and am working in order to obtain a reliable white alloy, and feel some hope at last of securing one; but, as Rudyard Kipling says, "that is another story."

ALTERATIONS IN SHAPE OF TEST PLUGS, EACH POINT = HUNDREDTH OF A MILLIMETRE.

(1) *Pearce's Amalgam.*

Shrank $2\frac{1}{2}$ in 1st quarter of an hour.
,, $1\frac{1}{2}$,, 2nd ,, ,, ,,
,, $\frac{2}{3}$,, 3rd ,, ,, ,,
,, 1 ,, 4th ,, ,, ,,
,, $1\frac{1}{3}$,, 5th ,, ,, ,,
,, $\frac{2}{3}$,, 6th ,, ,, ,,
,, $\frac{2}{3}$,, 7th ,, ,, ,,
,, $\frac{2}{3}$,, 8th ,, ,, ,,
,, $\frac{1}{2}$,, 9th ,, ,, ,,
,, $\frac{1}{4}$,, 10th ,, ,, ,,
,, $\frac{1}{2}$,, 11th ,, ,, ,,
,, $\frac{1}{2}$,, 12th ,, ,, ,,
,, $\frac{1}{2}$,, 13th ,, ,, ,,
,, $\frac{3}{4}$,, 12 hours following.
Total shrinkage, 12 in $16\frac{1}{4}$ hours.

(2) *Alba Alloy.*

Shrank $1\frac{1}{2}$ in 1st quarter of an hour.
,, $\frac{1}{2}$,, 2nd ,, ,, ,,
,, $\frac{1}{2}$,, 3rd ,, ,, ,,
,, $\frac{1}{2}$,, 4th ,, ,, ,,
,, $\frac{1}{2}$,, 5th ,, ,, ,,
,, $\frac{1}{2}$,, 6th ,, ,, ,,
,, $\frac{1}{2}$,, 7th ,, ,, ,,
,, $\frac{1}{2}$,, 8th ,, ,, ,,
,, $\frac{1}{2}$,, 9th ,, ,, ,,
,, $\frac{1}{2}$,, 10th ,, ,, ,,
,, $\frac{1}{3}$,, 11th ,, ,, ,,
,, 0 ,, 12th ,, ,, ,,
,, $\frac{1}{3}$,, 13th ,, ,, ,,
,, 0 ,, 14th ,, ,, ,,
,, $\frac{1}{3}$,, 15th ,, ,, ,,
,, 0 ,, 16th ,, ,, ,,
,, 0 ,, 17th ,, ,, ,,
,, 0 ,, 18th ,, ,, ,,
Regained $3\frac{1}{2}$ subsequently. Total shrinkage, $3\frac{5}{6}$ points.

(3) *Welsh.*

Shrank 1 in 1st quarter of an hour.
,, 1 ,, 2nd ,, ,, ,,
,, 1 ,, 3rd ,, ,, ,,
,, 1 ,, 4th ,, ,, ,,
,, 1 ,, 5th ,, ,, ,,
,, $\frac{1}{2}$,, 6th ,, ,, ,,
,, $\frac{1}{2}$,, 7th ,, ,, ,,
,, $4\frac{2}{3}$,, 8 hours following
,, $\frac{1}{3}$,, 1 week following
Total shrinkage, 11 in 1 week $9\frac{3}{4}$ hours.

(4) *Flint Edge Gold Alloy.*

Shrank 1 in 1st quarter of an hour.
,, $\frac{5}{6}$,, 2nd ,, ,, ,,
,, $\frac{7}{12}$,, 3rd ,, ,, ,,
,, $\frac{7}{12}$,, 4th ,, ,, ,,
,, $\frac{7}{12}$,, 5th ,, ,, ,,
,, $\frac{7}{12}$,, 6th ,, ,, ,,
,, $\frac{5}{6}$,, 7th ,, ,, ,,
,, $\frac{5}{6}$,, 8th ,, ,, ,,
,, 1 ,, 5 days following.
,, $1\frac{1}{3}$,, 7 days following.
Total shrinkage, 8 in 12 days 2 hours.

(5) *Davis' Gold Alloy.*

Shrank 1 in 1st quarter of an hour.
,, 1 ,, 2nd ,, ,, ,,
,, $\frac{1}{2}$,, 3rd ,, ,, ,,
,, $\frac{3}{4}$,, 4th ,, ,, ,,
,, $\frac{1}{4}$,, 5th ,, ,, ,,
,, 0 ,, 6th ,, ,, ,,
,, 0 ,, 7th ,, ,, ,,
,, 0 ,, 8th ,, ,, ,,
Regained $\frac{1}{2}$ in 5 days following.
Total shrinkage, 3 in 5 days 2 hours.

(6) *Submarine washed in Methylated Spirit.*

Shrank $1\frac{1}{2}$ in 1st quarter of an hour.
,, 1 ,, 2nd ,, ,, ,,
,, 1 ,, 3rd ,, ,, ,,
,, 0 ,, 4th ,, ,, ,,
,, 0 ,, 5th ,, ,, ,,
,, 0 ,, 6th ,, ,, ,,
,, 0 ,, 7th ,, ,, ,,
,, 0 ,, 8th ,, ,, ,,
Regained $1\frac{1}{2}$ in 3 days following.
Total shrinkage, 2 in 3 days 2 hours.

(7) *Submarine unwashed.*

Shrank 2 in. 1st quarter of an hour.
,, $\frac{2}{3}$,, 2nd ,, ,, ,,
,, $\frac{1}{3}$,, 3rd ,, ,, ,,
,, $\frac{1}{4}$,, 4th ,, ,, ,,
,, 0 ,, 5th ,, ,, ,,
,, 0 ,, 6th ,, ,, ,,
Regained $\frac{1}{2}$ in 2 days following.
Total shrinkage, $2\frac{3}{4}$ in 2 days $1\frac{1}{2}$ hours.

(8) *Black No. 2 formula annealed.*

Shrank in 1st quarter of an hour.
Regained 1 in 2 hours following.
Total shrinkage, *Nil* in 2 hours.

(9) *Black No. 1 formula annealed.*

Shrank $\frac{1}{4}$ in 1st quarter of an hour.
,, $\frac{1}{3}$,, 2nd ,, ,, ,,
,, 0 ,, 3rd ,, ,, ,,
,, 0 ,, 4th ,, ,, ,,
,, 0 ,, 5th ,, ,, ,,
,, 0 ,, 6th ,, ,, ,,
,, 0 ,, 7th ,, ,, ,,
,, 0 ,, 8th ,, ,, ,,
Total shrinkage, $\frac{7}{12}$ in 2 hours.

(10) *Black No. 1 annealed.*

Shrank $\frac{1}{2}$ in 1st quarter of an hour.
,, $\frac{1}{6}$,, 2nd ,, ,, ,,
,, 0 ,, 3rd ,, ,, ,,
Gained $\frac{1}{6}$,, 4th ,, ,, ,,
,, 0 ,, 5th ,, ,, ,,
,, 0 ,, 6th ,, ,, ,,
,, $\frac{1}{6}$,, 7th ,, ,, ,,
,, 0 ,, 8th ,, ,, ,,
Total shrinkage, $\frac{1}{3}$ in 2 hours.

(11) *Black No. 1 formula annealed.*

Shrank 1 in 1st quarter of an hour.
,, 0 ,, 2nd ,, ,, ,,
Regained $\frac{1}{4}$,, 3rd ,, ,, ,,
Total shrinkage, $\frac{3}{4}$.

(12) *Black No. 1 formula unannealed.*

No change in 1st quarter of an hour.
,, ,, 2nd ,, ,, ,,
,, ,, 3rd ,, ,, ,,
Expanded $\frac{1}{12}$,, 4th ,, ,, ,,
No change ,, 5th ,, ,, ,,
Expanded $\frac{1}{4}$,, 6th ,, ,, ,,
,, $\frac{1}{4}$,, 7th ,, ,, ,,
20 hours total gain, 7 points.

(13) *Copper Amalgam.*

No change	in	1st	quarter	of	an hour.
,,	,,	2nd	,,	,,	,,
,,	,,	3rd	,,	,,	,,
,,	,,	4th	,,	,,	,,
,,	,,	5th	,,	,,	,,
Shrank	$\frac{1}{4}$,,	6th	,,	,,	,,
No change	,,	7th	,,	,,	,,
,,	,,	8th	,,	,,	,,
,,	,,	9th	,,	,,	,,
,,	,,	10th	,,	,,	,,

Shrank 1 in 10 days following.
Total shrinkage, $1\frac{1}{4}$ in 10 days $2\frac{1}{2}$ hours.

(14) *Eckfeldt Dubois.*

Shrank $3\frac{1}{2}$ in 1st quarter of an hour.
Regained 1 in 12 hours following.
Total shrinkage, $2\frac{1}{2}$ in 12 hours.

Further Notes on the Bacteriology of the Mouth.[1]

By Kenneth W. Goadby, L.D.S.Eng.

There is no region of the body more exposed to the advent of micro-organisms, unguarded from their entrance and adapted to their growth, than the mouth; in fact, at one time or another most known organisms may be found therein. The bacteria of virulent disease have frequently been observed even in perfectly healthy individuals, to be present in the oral cavity, organisms which, if transmitted to a susceptible person, would undoubtedly produce serious, nay, perhaps fatal results.

The perception and appreciation of these facts is one of most vital interest to all who practise dental surgery.

The most superficial and casual observer is at once struck by the fact that all mouths contain bacteria, although the numbers and species vary within wide limits and bear a distinct relation to the environment of the subject.

---

[1] A grant from the Scientific Grant Committee of the British Medical Association was made in aid of this research.

Notwithstanding the enormous variety of organisms that may occur in the mouth, there appears to be a distinct flora, flourishing most in uncleanly conditions and decreasing to but a few species in normal healthy mouths.

I have been especially interested in the bacteria which are to be found in unhealthy mouths, and whose biological characters have so far not been described.

In the course of his investigations the writer has also been able to confirm the results embodied in a previous paper read before this Society.[1] In every case examined the writer has been able to isolate a streptococcus, identical with the one described, whilst other observers have isolated a similar organism, and a series of experiments has conclusively proved that the diplococci normally occurring in the mouth grew out into the streptococcus brevis when cultivated. Cover glasses were coated with agar and planted with the diplococci of the mouth, the preparation being so arranged that it could be examined microscopically. After incubation the diplococci were found to have developed into streptococci which gave the cultural peculiarities of streptococcus brevis.

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[1] Dr. Washbourn and Mr. Goadby, *Trans. Odont.*, vol. xxviii., No. 8.

Another observer states in the Bacteriological Report of the Clinical Research Association that he has been enabled to separate the streptococcus brevis from the streptococcus pyogenes by the cultural differences we described.

I have not at present made any further experiments on the pathogenic properties of the mouth streptococcus.

The favourite site for bacterial growth is along the gum margin and the spaces between the teeth, a condition no doubt arising from the accumulation of food, and the inability of the tongue to clear such places.

In patients suffering from gingivitis marginalis or from pyorrhœa alveolaris, enormous quantities of bacteria are to be found along the gum margins, and in the "pockets" in this region; in fact, the white deposit (or materia alba of Leeuwenhœk) is simply a teeming mass of bacteria; how any teeth resist this invading host is a mystery, many of them being acid producers and capable of liquefying gelatin.

The same condition, but in a lesser degree, occurs wherever tartar is present upon the teeth in any quantity, and where occurring locally, as on one or more upper molars, there a corresponding increase of organisms takes place even in an otherwise healthy mouth. The removal of the tartar and the use of antiseptics restoring the part to a normal condition.

In the paper to which I have already referred, the case of a boy was cited who, tiring of the repeated cultivations made from his mouth, took to the use of a tooth brush, thereby despoiling us of a fruitful source of spirilla, and it is worthy of note that up to the present time the spirilla and unhealthy conditions have not returned.

The removal of carious teeth and septic roots also rapidly diminishes the number of organisms present, and the author has found that often the only organism remaining is the streptococcus, although many species were present in the first place; under these circumstances the practice of leaving roots in the mouth and covering them with a denture cannot be too greatly deprecated, whilst on the other hand the writer entirely agrees with Tomes that previous to the removal of such teeth, the application of antiseptics may do much to prevent local or general infection, which, though rare, does at times undoubtedly occur.

In all the unhealthy mouths the writer has examined (fifty in all) two organisms or types of organisms were found, viz., vibrios (spirilla and commas), and huge thick jointed threads, whilst besides these short motile bacilli are always to be met with. Before discussing these bacteria, however, it will be as well to say a few words about certain well-known organisms not peculiar

to the mouth, but which are constantly to be found in it.

Chromogenic bacteria of many species are often to be found in the mouth, and invariably under diseased conditions of that cavity. Miller claims to have isolated eight different organisms producing a yellow colour; Freund isolated eighteen different chromogenic species.

Among well-known organisms producing pigmentation, the writer has frequently found a variety producing a beautiful green colour, viz., B. fluorescens non liquefaciens (motilis), an organism commonly found in water. Podbielskij, Rosenthal and others have noted this organism, whilst Mr. Pakes, of Guy's Hospital, informs me that he has often found it in cultures made from the mouth. Miller describes, or rather mentions, a "vibrio" which produces a green colouration which from the meagre remarks is probably the organism referred to above; the B. fluorescens in question is extremely motile and may have so misled the observer.

In all the mouths from which the author obtained this chromogenic organism the tartar was stained a greenish colour, whilst in two of the cases distinct green staining of the front upper teeth was present.

Miller's assertion that green staining cannot be accounted for by an organism which only

colours the medium, and is itself colourless, is by no means in keeping with observed facts, especially when we consider the case of "blue-pus" coloured by the B. pyocyaneus, and it seems perfectly reasonable to suppose that a bacillus growing along the necks of a tooth may diffuse its pigment over the tooth surface.

Staphylococci are another variety of organism constantly to be met with in unclean mouths, and of these the most common is the albus; in this my researches agree with Nettler; the other staphylococci, aureus and citreus also occur, the former being least common, and occurring in about 7 per cent. of cases.

Yeasts are almost always present, and the writer has several times obtained the rosa hefa giving a fine rose pink colouration.

A short motile bacillus producing a fine red colour has been obtained from five mouths.

Morphology.—Extremely short bacilli with rounded ends, often occurring in pairs and looking extremely like a diplococcus; a twenty-four hours' broth culture shows distinct motility, stains with usual aniline dyes; spore formation not observed.

Biological Characters. Agar.—Smooth raised streak, whitish with defined edge in forty-eight hours. Pinkish colour after three days, eventually becoming red.

Potato.—Slow colouration, seven to fourteen days; curious bright red, globular or bead-like colonies.

Broth.—Twenty-four hours, slight opacity, no marked turbidity; stringy precipitate with a faint red tinge in five days. Motile bacilli.

Gelatin.—Very slow growth, no liquefaction, but growth to bottom of stab, colour only at top; nail growth.

Litmus Milk.—Grows fairly well, acid reaction in several days, generally seven to ten, colour eventually reduced; no clotting. Miller figures a red coccus, giving pigment aerobically only. Rosenthal also mentions a red coccus, micrococcus roseus, obtained from the mouth.

A great many other chromogenic bacteria are to be found in the mouth, but space does not admit of their further discussion.

Among the special mouth organisms none have attracted so much attention as those thread-like and filamentous forms unhappily grouped under the term "leptothrix," by Robin, Hallier, Vignal and many others, for no special reason apparently than that they exist in the mouth in thread-like forms. Miller, who was the first to recognise the inadequacy of the term leptothrix as applied to any thread-forming organism, and being unable to cultivate them upon artificial

media, provisionally divides the filamentous forms of the mouth into three species, morphologically and according to their reaction with acidulated iodine, as follows:—

(*a*) *Leptothrix innominata*, thin wavy threads with little or no segmentation, and giving a yellow colour with acidulated iodine; (*b*) *Bacillus maximus buccalis*, thick, much jointed threads generally giving a blue colouration with iodine; (*c*) *Leptothrix buccalis maxima*, similar to (*b*) but with larger joints and giving no reaction with iodine.

This reaction to iodine can scarcely be considered a sufficient difference between a "leptothrix" and a bacillus, whilst if any bacillus which forms threads is to be *ipso facto* a leptothrix, then under this head come most known bacilli, and many if not most vibrios. Leptothrix is a term that should be used to express a species and not a morphological form. In Baumgarten's classification a leptothrix is described thus: Spherical, rod shaped, or filamentous forms, the last showing a difference between the two extremities; spore formation not known. Cocci like reproductive bodies are formed by segmentation of the rod-shaped elements.

If we take a small portion of the white deposit from the gum margins of individuals suffering from gingivitis marginalis, or pyorrhœa alveolaris,

and make a coverslip preparation, the slide invariably shows one or more of the thread-like forms noted above (*vide* fig. 1), and in making cultures from such cases I have succeeded in isolating a thick, heavily jointed organism, which grows out into long threads and appears to be the "leptothrix buccalis maxima" of Miller, if we are guided by the iodine reaction; but as the organism to be described is not a leptothrix in Baumgarten's sense of the term, the author has decided to reserve the term "Bacillus maximus buccalis" for this organism, a most decided bacillus and which, if labled as a leptothrix, would only complicate the confusion extant in the nomenclature of mouth bacteria.

At first the writer had great difficulty in obtaining even an impure culture of this bacillus; many media were tried with no avail, although many interesting results were obtained in relation to the growth of mouth bacteria generally.

(1) Mouth bacteria grow best upon an alkaline medium; a series of percentages of normal NaOH were tried varying from ·1 to 20 per cent.; 1 per cent. gave the best results, so we now add 10 cc. of normal NaOH per litre of broth, &c., after neutralisation.

(2) All mouth bacteria flourish best when the medium contains gelatin, so that broth made with shin of beef is better than broth from beef steak; and gelatin-agar better than agar.

(3) The addition of a small percentage of potassium sulpho-cyanide does not prevent the growth of many mouth organisms, the mouth streptococcus often growing in ·5 per cent. of that salt.

(4) The mouth streptococcus constantly outgrows other forms, and so on with many other minor points which would only weary you to discuss.

The first cultures of the bacillus maximus buccalis were obtained in the following way: (1) Broth was inoculated from a mouth direct, the cover-slip preparation showing the organism in question. (2) Cultures upon agar were made at intervals after the first three days, and (3) eventually plating from the impure culture obtained.

So far a pure culture has not been obtained by plating direct from the mouth, the organism in common with the spirillum presently to be described evidently requires some time to adapt itself to the new environment.

The above method is tedious, and better and more certain results are to be obtained by the method used for the spirilla. The organism occurs in all dirty and uncleanly mouths, and not infrequently upon the tonsil, although it appears to be present in the greatest numbers in mouths where a large amount of caries exists.

Morphology.—Thick jointed threads (*vide*

FIG. 1.—*Bacillus buccalis maximus*, &c., from mouth (direct) x 1,000.

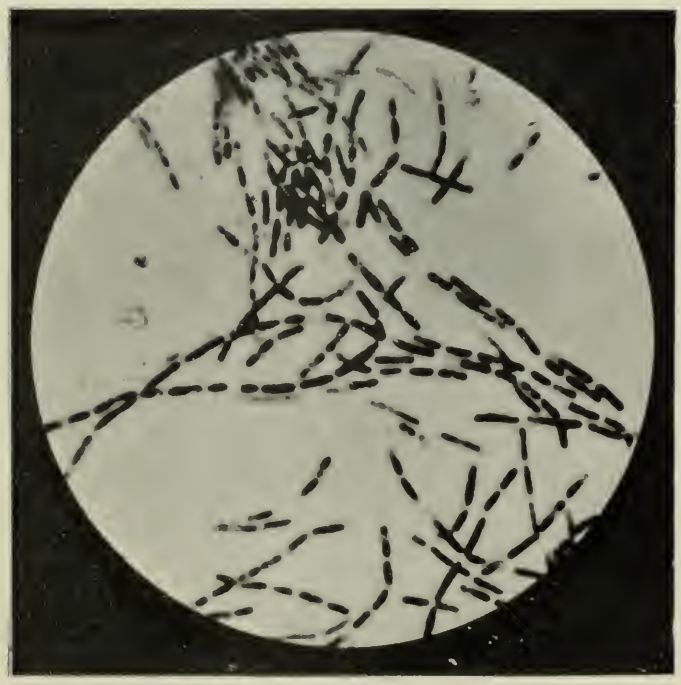

FIG. 2.—*Bacillus buccalis maximus*, from mouth (3 days agar cultivation stained gram) x 1,000. The clear unstained spaces in some of the bacilli are spores.

fig. 2) 1 to 1·5 μ broad, 10 to 20 μ long; some threads may be even larger than this, others curved and twisted, especially in old cultures on potato. The individual elements are 1 to 4 μ long but may be much larger, the ends are squarish or rounded; it stains by Gram's method and by ordinary dyes. With carbolic methyline blue, red granules often appear. In old cultures (four to ten days) the threads stain irregularly, especially with carbo. meth. blue; some of the unstained spaces appear to be vacuoles, others are highly refractile spores; these spores stain a deep red by Möller's method.

A twenty-four hours' culture on broth or agar is motile, especially the shorter isolated segments which have a twisting and irregular motion; some of the long threads are also motile and may move in a spiral manner. The flagella may be stained by Pittfield's method; the maximum number appears to be six, two terminal and four lateral; there are generally only one or two lateral or isolated bacilli in the threads; I am not, however, quite certain as to the number of flagella.

The bacilli do not stain purple with Miller's iodine, although at times portions of the rod stain a faint blue. In old cultures the rods appear granular, and many large, irregular, oval or round involution forms occur.

Biological Characters.—Aerobic and facultative anaerobic, *i.e.*, grows both in presence and absence of oxygen. It quickly liquefies gelatin. (*a*) *Stab cultures*: a distinct cone-shaped liquefaction in twenty-four hours. No liquefaction in depths, but good growth to bottom of stab; forty-eight hours lower parts liquefy. (*b*) *Streak cultures*: twenty hours, deep groove of liquefaction with whitish flocculi in liquid. (*c*) *Gelatin plates*: twelve hours, whitish grey, flat round colonies, 2·5 to 5 mm. wide, with slightly darker central spot when viewed by transmitted light.

Microscopically (1 in. obj.), irregular dentated edge, slightly yellow, with darker brown irregular centre with feathery edge overlying the outer and lighter part which contains irregular fibres.

Agar.—Twelve hours, brownish grey streak with regular defined wavy edge; with a pocket lense the surface is distinctly granular having the appearance of frosted glass—thick, easily scraped up with spatula. The bacilli grow out into long articulated threads.

Broth.—Twelve hours, granular precipitate with masses floating in fluid, no pellicle and little turbidity; twenty-four to forty-eight hours, more turbidity and precipitate; no pellicle. A pellicle may be formed later, three to five days, and on peptone water in about the same time. Hanging

drop, mostly short thick bacilli distinctly motile but not excessively so.

Litmus Milk.—Twelve hours, distinct acid reaction, colour eventually reduced; no clotting in six days.

Blood Serum.—Twelve hours, slightly raised, moist, whitish growth; no further change in five days.

Potato.—Twelve hours, thick and well marked, moist, raised, greyish growth; twenty-four hours, brownish grey, hanging drop, motile. Soon forms spores.

Spore Formation.—In a twelve days' culture many oval or oblong highly refractile bodies may be seen, not staining with the ordinary dyes, and and forming curious chains with the long axes parallel. On staining by Möller these bodies are stained a deep red, the bacilli blue. The spores may often be seen in the bacilli (*vide* fig. 2). If some of the culture be suspended in broth and maintained at 70° to 75° C. for half an hour the bacilli are destroyed but the spores are not and develop on agar streaks in the usual way. A five days' culture on peptone water gives no colouration with pure sulphuric acid, or on addition of sodium nitrite. No gas bubbles appear in gelatin shakes, whilst ·05 gm. per cent. of potassium sulpho-cyanide does not prevent growth.

Choquet has described three varieties of "Leptothrix Buccalis" (*sic*) obtained from three different mouths of insane individuals, and, to quote his own words "whether the general condition favours the growth of 'the leptothrix' to the exclusion of other forms I leave others to say." He does not state if "the leptothrix" occurs in his own mouth.

In all unhealthy mouths, and especially in the early stages of pyorrhœa alveolaris, the writer has observed vibrios, of both comma and spiral form, these are the well-known *spirillum sputugenum* and *spirochæta dentum* (*vide* figs. 3 and 4), and which so far have resisted all attempts at cultivation.

The writer, after repeated endeavours, extending over a period of more than two years, and after many failures, has obtained a method by which these refractory organisms may be isolated, although at present it is impossible to say if all the spiral forms met with belong to the same species; so far, however, all the cultures obtained, twelve in all, correspond with one another in their main characteristics.

On the surface of alkaline potato gelatin the writer has obtained the spirillum five times from five consecutive cases. Three other cultures were obtained at an earlier period of the investigation, but as the method did not always prove

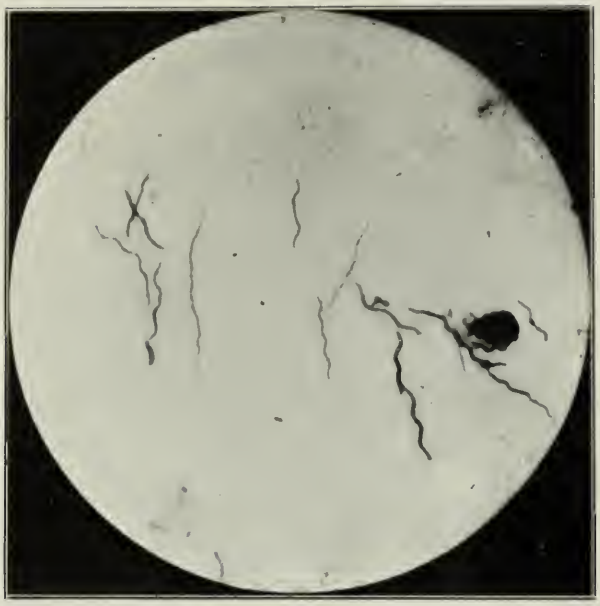

FIG. 3.—*Spirillum Sputugenum*, from mouth (direct), x 1,000.

FIG. 4. —*Spiochæta Dentum*, from mouth (direct), x 1,000. cp. c fig. 6.

successful it was thought better to defer the description of the spirilla until a method had been discovered whereby the vibrios might be grown with certitude. These conditions appear now to be fulfilled.

During the research many media have been tried, with varying degrees of alkalinity; media made with egg albumin as basis instead of meat extract, infusions of glands, saliva broth with different percentages of pot. sulpho-cyanide, mucin media made from snail mucin, vegetable juices, and many others. Three times a pure culture was obtained by the use of egg broth, made by adding four eggs to a litre of water, with 1 per cent. of peptone and lactose, and ·5 per cent. salt; the medium is then neutralised so that the albumin is converted into alkali albumin in such a way that a slight trace of acid produces a precipitate. On this medium a slight growth occurred, and upon streaking on to saliva agar and then plating, a pure culture was obtained. The spirilla will grow also for a short time upon mucin gelatin (2 snails to 100 cc. water) but soon die out.

The potato gelatin is made by extracting one kilo grated raw potato with a litre of water for two hours, and, after adding gelatin and boiling, two eggs are added (whites only), reboiled, neutralised, and 1 per cent. normal NaOH added.

On this medium the spirilla grow in conjunction with other mouth bacteria, among them B. maximus buccalis as mentioned above, and by adopting proper precautions a pure culture may be obtained. The method is the following: (1) inoculations from mouth direct on to slanted potato-gelatin, development is extremely slow. (2) After three days a second slant is inoculated from any minute pin's point colonies which show spirilla, if the second tube shows growth there is little difficulty in obtaining a pure culture; on the other hand, plating from the first tube is generally successful, the point to be remembered is that the organisms require time to accustom themselves to the altered conditions of surroundings, but if left too long may be exterminated by the development of other bacteria.

On the gelatin plates at the end of four to five days, minute, ill-defined, grey-white, moist colonies are to be seen, the hanging drop showing distinct spiral motion, but on staining, the spirilla are far from typical (*vide* fig. 7). Potato-gelatin streaks from these colonies develop slowly; in three days minute pin's-point colonies may be seen along the streak, even now these will not grow in the hot incubator. After a variable time, however, the growth is more pronounced, and on transference to agar at 22° C., a good development of beautiful spiral and comma-

shaped forms appear at the end of twenty-four hours in the form of a whitish, raised, moist streak.

Potato water, potato agar, and potato agar gelatin do not give such satisfactory results.

On boiled potato streaked from the mouth direct spirilla, as well as B. maximus buccalis, may be found at the end of twenty-four hours, but a transference to even potato gelatin does not give satisfactory results.

Large slices of potato in petrie dishes have also been tried with but poor results, it being extremely difficult to see the minute colonies on the surface of this medium.

From these results it will be seen that the organism is difficult to isolate, but may be obtained by the above method.

At one time the mouth commas were supposed to be the same as Koch's cholera vibrio, and Lewis, in the *Lancet* for 1884, advanced this view.

Klien also, in *British Medical Journal*, 1885, says the comma bacilli of the mouth have the same characters as cholera, but gives no details. Miller, in *Independent Practitioner*, 1885, describes an organism having the characters of the Finkler Prior vibrio. He also mentions one organism producing spiral forms, but does not even state if it was motile or not.

Nettler found the spirochaete dentum in the

pus from a putrid empyema. The author has also found the same organism in the pus from a diffuse suppuration following the removal of an upper second molar; the mouth of the patient in question contained many spiral forms, and a few were to be found in the pus of the drainage tubes in the face which did not communicate with the cavity of the mouth. The spirillum cultivated by the writer has the following characteristics:—

Morphology.—Vibrio, occurring in young cultures as comma-shaped rods ·1 to ·3 μ in breadth, 1 to 2·5 μ long, with rounded, or pointed ends (*vide* fig. 5).

In older cultures growing into well-marked spirilla, some composed of commas united in series, others spirilla with four or five turns without a break, very long threads are also met with; these are often much thinner (spirochæta), the spiral forms are most common after forty-eight hours, and best marked on broth (*vide* fig. 6).

In old cultures curious swollen and twisted involution forms are to be seen; some of these are at the ends of the spirilla and commas, and present a similar appearance to the forms seen in the mouth itself, and not unlike flagella (*vide* figs. 6 and 3). Curious spherical bodies are at times to be seen in the course of the spirilla

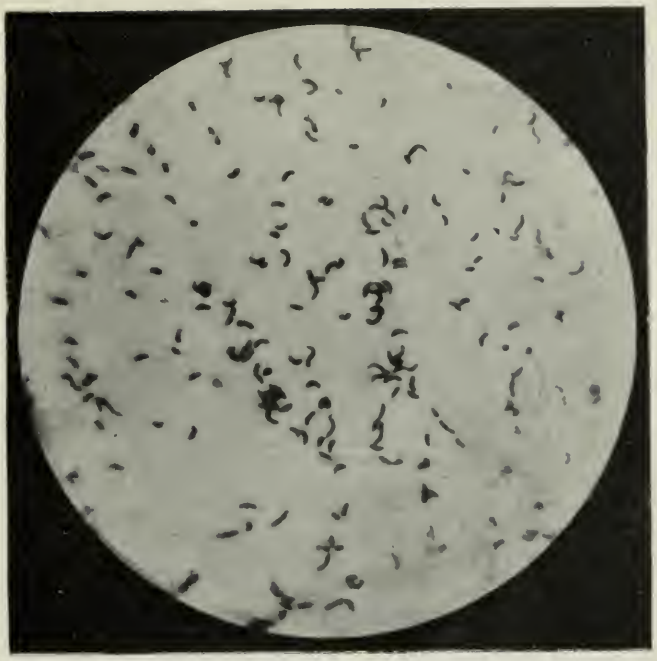

FIG. 5.—*Spirillum Sputugenum*, from mouth (1 day agar cultivation) x 1,000. Comma forms.

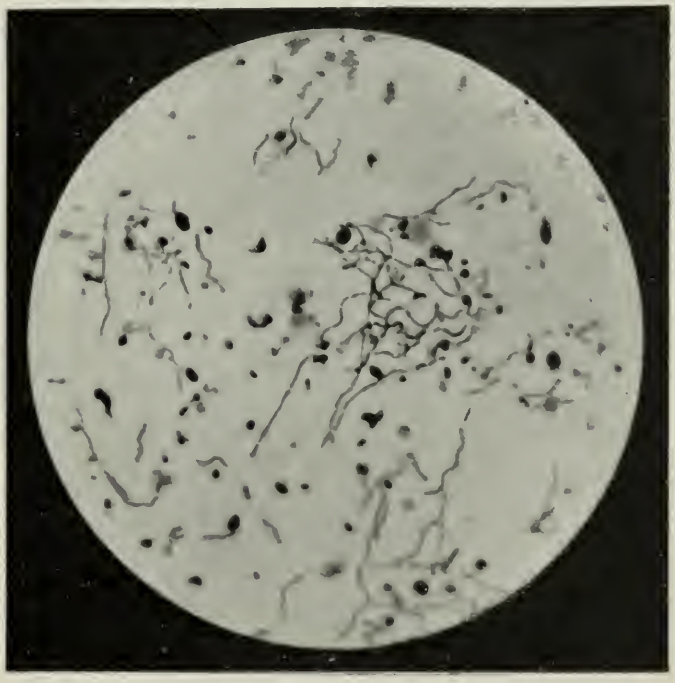

FIG. 6.—*Spirillum Sputugenum*, from mouth (4 weeks' agar cultivation) x 1,000. Showing involution forms, &c.

similar to the so-called arthrospores described by Hueppe in the cholera vibrio, spherical bodies are also to be seen with no spirilla (*vide* fig. 6) attached. No endogenous spores have been observed, Stains with difficulty, best with carbolic fuchsin, or carbolic spillers purple, or by aniline gentian violet after treatment with alcohol.

In old cultivations the threads and spirilla stain badly and often have the appearance of chains of bacilli with an unstained interval between them (*vide* figs. 6 and 7).

It does not stain by Gram's method.

A twenty-four hours' broth culture is extremely motile, it often being difficult to observe under the $\frac{1}{12}$ in. lens in the hanging drop.

Upon staining by Pittfield's method, or by *night blue* a single terminal flagellum may be seen.

Biological Characters. — Aerobic, facultative anaerobic, motile, liquefying, spirillum.

Gelatin Plates.—At the end of forty-eight hours, minute greyish white colonies, very much like streptococci, moist, and flat. Liquefaction commences soon after.

Microscopically (1 in.).—Brownish, round, or slightly oval, not granular, with darker, irregular central area opaque.

Agar colonies similar, but less colour, and without darker area.

Stabs.—Cup-shaped liquefaction in four days, little fluid, the tube may often be inverted without the liquefied mass running out, white flocculi in liquid and at bottom. The rate of liquefaction varies somewhat in different specimens, and is as a rule longest in cultures recently isolated.

Streak.—Groove of liquefaction in three days.

Agar.—Good growth in twenty-four hours; greyish, raised, moist growth, with well defined straight edge, colonies may, however, be separate and form greyish, round, smooth, defined patches, eventually becoming confluent.

In *agar stabs* growth takes place to bottom of puncture but does not develop much; a film soon spreads over the surface. In three to six days a brownish buff colour appears in the central and thicker parts of the streak. In old streaks on agar the surface may be raised into hillocks, or be irregularly raised and wrinkled; the appearance on agar is extremely variable.

Blood Serum.—Twenty-four hours, brownish streak with slight amount of liquefaction. Forty-eight hours little change, liquefaction extremely slow.

Litmus Milk.—Twenty-four hours, well marked acid reaction, with well marked clotting in seven days, sometimes less.

Broth.—Twenty-four hours, general turbidity and slight trace of pellicle. Seventy-two hours,

FIG. 7.—*Spirillum Sputugenum* from mouth. Freshly isolated cultivation, x 1,000.

well marked pellicle. A four or five days' culture on broth or peptone water, gives well marked "cholera red reaction" with pure sulphuric acid.

Potato.—No apparent growth in twenty-four hours at 37° C. Two to three days at 22° C., well marked, rich red brown colouration, moist and shiny. Involution forms and threads often formed (*vide* fig. 7).

The writer has compared this organism with Koch's cholera spirillum, and those of Metchnikoff and Finkler Prior. It is not unlike them in many respects, but has important points of difference. Like the v. cholera and v. Metchnikoff, it gives a well marked cholera red reaction, which is not given by v. Finkler Prior, and although it liquefies gelatin, does not do so with such rapidity as the latter organism; in fact, in recently obtained cultures little or no liquefaction occurs. Slight liquefaction of blood serum takes place, more like the effect produced by v. cholera and v. Metchnikoff.

On litmus milk it produces more acid than v. Finkler Prior, and a clot is finally formed more like v. cholera and v. Metchnikoff. The appearance on broth varies but is not so rapid as either of the other three.

The growth on potato occurs at the ordinary temperature of the room, thus differing from v. Metchnikoff and cholera, and is more rapid.

The cultures I am passing round illustrate these points. From the foregoing results the spirillum the writer has isolated appears to be a distinct species, and must be regarded as such, but that all the spiral forms met with in the mouth belong to this organism alone is highly improbable, at the same time most of the commas and spirilla are to be referred to the spirillum described, the evidence adduced being certainly in favour of this view.

In summing up, the conclusions the author draws from the various results set forth in this paper are these :—The filamentous forms occurring in the mouth are by no means therefore leptothracæ, and one of them at any rate has been conclusively proved to be a bacillus capable of spore formation and thread production, whilst other bacilli which space prevents me describing, also produce thread-like forms. The B. maximus is also an organism whose relation to dental caries is important both from its power to produce acid and the ease with which it liquefies gelatin.

Spirillum sputugenum and spirochæta dentum are to be found in inflamed conditions of the gums, and especially in pyorrhœa alveolaris, these organisms being forms of one variety, whose cultures differ from other known spirilla, whilst the difficulty of obtaining pure cultivations

is due to the reluctance with which the organism takes on a saprophytic existence, as well as the restraining influence of other organisms. Finally that both organisms though they may exist in healthy mouths, are present in most profusion wherever inflammatory and pathological conditions are found.

Organism	Gelatin	Lit. Milk	Agar	Broth	Potato	Blood Serum	Colonies—Gelatin
Vibrio cholera	24 hours, no liquefaction; 48 hours, liquefaction commencing	24 hours, slight acid; 48 hours, marked acid; 7 days, clot	24 hours, moist white layer, defined edge	24 hours, slight pellicle, fluid slightly cloudy; 48 hours, more pellicle	24 hours, no growth; 48 hours, no growth; 3 days, faint growth	24 hours, yellow-brown streak, slight liquefaction; 48 hours, similar	24 hours, pale yellow, irregular, coarsely granular
Vibrio Metchnikoff	24 hours, no liquefaction; 48 hours, liquefaction commencing	24 hours, slightly acid; 48 hours, more acid; 7 days, clot	24 hours, moist yellowish-white streak	24 hours, cloudy, with pellicle; 48 hours, more pellicle	24 hours, no growth; 48 hours, no growth; 3 days, faint growth	24 hours, yellow-brown, slight liquefaction; 48 hours, similar	24 hours, similar to v. cholera
Vibrio Finkler Prior	24 hours, well-marked liquefaction; 48 hours, large deep iquefaction	24 hours, no acid; 48 hours, no acid; 7 days, no clot	24 hours, moist slimy layer, spreading over surface	24 hours, cloudy, slight pellicle; 48 hours, more pellicle	24 hours, no growth; 48 hours, no growth; 3 days, creamy yellow growth	24 hours, well-marked groove of liquefaction; 48 hours, half liquefied	24 hours, minutely granular, yellow and yellow-white, liquefaction
Spirillum Sputugenum	24 hours, no liquefaction, 48 hours, slight liquefaction	24 hours, acid reaction; 48 hours, more acid; 7 days, clotting	24 hours, moist grey-white raised streak, centre yellowish, defined edge	24 hours, slight turbidity; 48 hours, more turbidity; 72 hours, pellicle; 96 hours, clear fluid, wrinkled pellicle	24 hours, no growth; 48 hours, faint brown tinge; 3 days, well marked	24 hours, brownish layer, slight liquefaction; 48 hours, similar	24 hours, brownish, round and oval, not granular, with darker irregular centre

Discussion.

Dr. Washbourn said that, some two years ago, he had the pleasure of reading a paper before the Society upon some work relating to the bacteria of the mouth undertaken by Mr. Goadby and himself. At that time they paid special attention to the mouth streptococci, and they found it was possible to cultivate from every mouth a streptococcus which bore a close resemblance to the ordinary streptococcus pyogenes. On the epithelium of the mucous membrane of the mouth there was always present a large number of cocci, generally in the form of diplococci, and they surmised that these were identical with the streptococci which they were able to isolate by cultivation. Since that time Dr. Schmidt had shown quite conclusively that they were right in their surmise. He took scrapings from the mucous membrane of the mouth and made agar cultivations which he examined directly under the microscope. By watching the diplococci in the epithelial cells from day to day he was able to see them develop into streptococci similar to those they were able to cultivate.

When he and Mr. Goadby wrote their paper they were able to confirm the observations of Miller and others, that there were very frequently present in the mouth leptothrix forms and spirilla. The word leptothrix was not a good one to use, because the term was properly applied to distinct species of bacteria belonging to the higher forms. However, the term was often used, rather loosely, to imply a morphological form consisting of filaments.

At the time of the paper referred to they were unable to cultivate either the leptothrix forms or the spirilla; and they thought that they were dealing with anaerobic bacteria; but Mr. Goadby had since worked the question out very carefully and found that this was not the case. By careful cultivation Mr. Goadby had been able to isolate the spirilla and one of the leptothrix forms. One of the most interesting points which Mr. Goadby had brought forward was that the spirilla could be cultivated on the ordinary laboratory medium, but that they required some time to get accustomed to their new surroundings. This, no doubt, was the reason why others had generally failed to cultivate spirilla from the mouth even when they were present in large quantities.

The spirilla were a very interesting series of organisms, more especially because they presented themselves under so many different morphological conditions. That had been well shown in the case of the cholera vibrio. This vibrio, which usually occurred either as a comma or a spirillum, might, under certain circumstances, exist as a quite straight rod. On the other hand, it often underwent degenerative changes and produced peculiar spherical bodies similar to those described by Mr. Goadby in his paper.

Great interest attached to the question of the connection between the mouth spirilla and the condition which was called pyorrhœa. He could not help thinking that the spirilla must bear some very distinct relation to the causation of that disease. If that were so, it seemed to him to be important for Mr. Goadby to continue his researches and to test the pathogenic effects of the spirilla on animals; because by such investigations he might possibly obtain a serum of value in the treatment of disease. Mr. Goadby had spent an enormous amount of time and trouble on his observations, and had tried a large number of methods, and he seemed to have definitely succeeded in cultivating both the filamentous organisms and the spirilla from every case in which he had been able to demonstrate their presence by microscopical examination.

Mr. F. J. Bennett congratulated Mr. Goadby upon his hard work and upon the success which he appeared to have obtained. He hoped Mr. Goadby would proceed further with the matter and eventually be the proud discoverer of the true nature of the pyorrhœa alveolaris.

The President echoed the sentiments expressed by Mr. Bennett and regretted that the hour would not permit of any discussion upon Mr. Goadby's very valuable paper.

Valedictory Address.

The President: Nothing remains now, gentlemen, but for me to deliver to you a few remarks upon leaving this chair. My year of office having expired, the time has arrived when I must vacate the chair for my successor. I do not propose to deliver a formal valedictory address, which must necessarily partake of a retrospect of the papers and discussions of the past year, both of which are, doubtless, quite fresh in the memory of all of you. But before I leave this chair I should like again to express my appreciation of the honour you have done me in placing me in the position of President of this Society, and to thank you for attending so constantly at the meetings. I would also congratulate you on the selection of President for the coming year. In Mr. Fairbank you will have an admirable President, who, I feel sure, will uphold the reputation and the best interests of the Odontological Society. Last, though not least, I beg to express my most hearty thanks to the Council and Officers for their assistance and support, and would especially mention the Secretaries, to whose labour the constant supply of papers and casual communications is chiefly due.

Mr. F. J. Bennett thought it would be out of order if the meeting terminated without proposing a vote of thanks to the President and office-bearers who were now about to take their departure.

Mr. Hepburn seconded the motion, which was carried with acclamation.

The President thanked the members for the vote; and the thanks of the Society having been accorded to the readers of the papers and contributors to the museum and donors to the library, the Session terminated.

The next meeting will he held on the second Monday in November.

INDEX.

A.

Accident in a boy involving the maxillary central incisors, notes of a case of, 98.
Ackland, Mr. W. R., showed a slight modification he had made in Mason's gag, 25; notes on catarrh of the antrum, 135.
Address, inaugural, 12.
Address, valedictory, 198.
Albert, Mr. H. L., presented the society two little teeth removed from child twelve months old, on account of the inner cusp lacerating the tongue, 2; on acute suppuration of the mandible followed by pyæmia and death, 10; paper on the sulphocyanide of potassium in saliva, 50.
Alteration of bye-laws. 156.
Amalgam, paper by Mr. W. R. Humby, 158.
Annual meeting, 149.
Annual report, Librarian's, 150.
Antral empyema with ear complication, notes on a case of, 97.
Apthorpe, Mr. S. R., notes on a case of antral empyema with ear complication, 97; notes of a case of accident in a boy involving the maxillary central incisors, 98.

B.

Balance Sheet, 152.
Baldwin, Mr. H., on rubber rings, 4; on chloroform in dental surgery, 26; on suppression of teeth in a monkey, 36; on excision of roots, 41; on death of Indians soon after losing their teeth, 47; on the strip matrix, 75; on gutta percha in conservative dentistry, 128.
Barrett, Mr. Ashley, on wearing away of the teeth of Indians, 48.
Barrett, Mr. F. W., showed a skull from north-west Canada, 46.
Barrett, Mr. Russell, notes on a case of composite odontome, 21; on a method of prolonging anæsthesia in operations on the mouth, 145.
Bennett, Mr. F. J., on wearing down of the teeth of Indians. 49; on formalin, 91; on case of persistent temporary teeth in a patient with dichotomous thumbs, 103; on gutta percha in conservative dentistry, 129; on bacteriology of the mouth, 197.
Bennett, Mr. Storer, on rubber rings, 4; exhibited specimen of gorilla's skull, 20; on odon-

tomes, 23; on Mr. Grever's exhibits, 43; on Mr. Storey's photographs, 77; on formalin, 93.

Brunton, Mr., exhibited a right maxillary second bicuspid tooth, 3; on the strip matrix, 73.

Buckmaster, Dr., on the sulphocyanide of potassium in saliva, 67.

C.

Catarrh of the antrum, notes on, 135.

Chloroform in dental surgery, note on, 25.

Clarke, Mr. Charles A., on a system of inserting gold fillings into mineral teeth, 37.

Coffin, Mr. Walter, on the sulphocyanide of potassium in saliva, 69; on formalin, 91.

Coleman, Mr., on a method of prolonging anæsthesia in operations on the mouth, 139.

Colyer, Mr. J. F., on chloroform in dental surgery, 26; showed some cases illustrating the diagnostic value of the X-rays, 76; paper on formaldehyde in the treatment of pulps, 78.

Composite odontome, Mr. R. Barrett's notes on a case of, 21.

Composite odontome, Mr. F. W. Richards' notes on a case of, 75.

Constant, Mr. Thomas Edward, proposed, 19; elected, 45.

Curator's report, 2, 19, 46, 133, 151, (Annual) 155.

Casual Communications:—

Ackland, Mr. W. R., read notes on catarrh of the antrum, 135.

Albert, Mr. W. H. L., presentation of two teeth, 2.

Apthorpe, Mr. S. R., read notes on a case of antral empyema with ear complication, 97.

Barrett, Mr. F. W., exhibition of skull, 46.

Barrett, Mr. Russell, read notes on a case of composite odontome, 21.

Brunton, Mr., communication on the strip matrix, 73.

Brunton, Mr., exhibition of tooth extracted owing to its crowded position, 3.

Clarke, Mr. Charles A., on a system he adopted of inserting gold fillings into mineral teeth, 37.

Coleman, Mr., communication on the method of prolonging anæsthesia in operations on the mouth, 139.

Colyer, Mr. J. F., showed some cases illustrating the diagnostic value of the X-rays, 76.

Grevers, Dr., exhibition of lantern slides illustrating diseases of the maxilla and mandible, 43.

Harding, Mr. W. E., exhibition of elephant's tooth dug up from a garden in Shrewsbury, 20.

Lloyd-Williams, Mr. H., read notes on cases of excision of roots and open bite in an adult, 38.

Maggs, Mr. W. A., showed a fragment of human mandible with tooth embedded, 5.

Mummery, Mr., exhibition of gorilla's skull, 20.

Richards, Mr. F. W., read notes on case of composite odontome, 75.

Schelling, Mr. Carl, read notes on cases, 6.

Storey, Mr. J. C., exhibited lantern slides, 76.
Thomson, Mr., read note on chloroform in dental surgery, 25.
Thomson, Mr. Geo., exhibited several teeth which had been stopped, 138.
West, Mr. Charles, notes of a case of persistent temporary teeth, 100.

D.

Dolamore, Mr. W. H., elected, 1; on formalin, 94.

E.

Election of officers and councillors for the year 1898-9, 149.
Ellwood, Mr., on formalin, 90.

F.

Formaldehyde in the treatment of pulps, paper by Mr. J. F. Colyer, 78.
Formalin, paper by Mr. C. J. Boyd Wallis, 84.
Further notes on the bacteriology of the mouth, paper by Mr. Kenneth W. Goadby, 171.

G.

Gabell, Mr. D. P., suggested taking stereoscopic views would be a great improvement in skiagraphs, 77.
Goadby, Mr., on acute suppuration of mandible followed by pyæmia and death, 9; on the sulpho-cyanide of potassium in saliva, 68; paper, further notes on the bacteriology of the mouth, 171.
Grevers, Dr. John E., proposed, 19; elected, 45; exhibited a series of lantern slides, 43.

H.

Harding, Mr. W. E., exhibited an elephant's tooth, 20; on chloroform in dental surgery, 28; on the strip matrix, 75; on a method of prolonging anæsthesia in operations on the mouth, 142.
Harsant, Mr. Frank, proposed, 37; elected, 73.
Hern, Mr. William, on excision of necrosed roots, 42.
Hewitt, Dr., on chloroform in dental surgery, 26.
Hickman, Dr., on acute suppuration of the mandible, followed by pyæmia and death, 10.
Hughes, Mr. Morgan, on formalin, 93.
Humby, Mr W. R., paper on amalgam, 158.

I.

Inaugural address, 12.

K.

Keele, Mr. Stephen, elected, 1.

L.

Librarian's report of additions to library, 1, 19, 37, 45, 73, 97, 133, 150, (annual) 150.

M.

Maggs, Mr. W. A., showed a fragment of left half of human mandible, with a tooth lying embedded horizontally in the bone, 5; on chloroform in dental operations, 28.
Malone, Mr. C. A., proposed, 45; elected, 97.
Matheson, Mr., on rubber rings, 3.

May, Mr. W., proposed, 45; elected, 97.
Method of prolonging anæsthesia in operations on the mouth, on a, 139.
Mummery, Mr., showed a gorilla's skull, 20.

N.

Neale, Mr. Breward, elected, 73.
Northcroft, Mr. George, on the strip matrix, 75; on formalin, 91.

O.

O'Duffy, Mr. Kevin E., proposed, 37; elected, 73.

P.

Partial suppression of teeth in a very hairy monkey, paper by Mr. Charles S. Tomes, 30.
Paterson, Mr., on a method of prolonging anæsthesia in operations on the mouth, 145.
Pedley, Mr. Denison, on gutta percha in conservative dentistry, 127.
Persistent temporary teeth in a patient with dichotomous thumbs, notes of a case of, 100.
Papers:—
Albert, Mr. H. L., sulpho-cyanide of potassium in saliva, 50.
Colyer, Mr. J. F., formaldehyde in the treatment of pulps, 78.
Goadby, Mr. Kenneth W., further notes on the bacteriology of the mouth, 171.
Humby, Mr. W. R., amalgam, 158.
Rushton, Mr. Wm., on the use of guttapercha in conservative dentistry, 105.
Tomes, Mr. Charles, partial suppression of teeth in a very hairy monkey, 30.
Wallis, Mr. C. J. Boyd, formalin, 84.

R.

Richards, Mr. F. W., notes on a case of composite odontome, 75.
Robbins, Mr. C., on chloroform in dental surgery, 29; on formalin, 90.
Roughton, Mr., notes of a case of acute suppuration of mandible, followed by pyæmia and death, 7; on catarrh of the antrum, 138.
Rushton, Mr. Wm., loss of teeth from being ligatured by india rubber, 5; paper on the use of gutta percha in conservative dentistry, 105.

S.

Schelling, Mr. Carl, showed plaster model and read notes of a case, 6; on excision of roots, 41.
Silk, Dr., on a method of prolonging anæsthesia in operations on the mouth, 144.
Snell, Mr. Norris, elected, 1.
Storey, Mr. J. C., exhibited lantern slides, 76.
Suppuration of the mandible, followed by pyæmia and death, case of acute, 7.

T.

The strip matrix, Mr. George Brunton on, 73.
The sulpho-cyanide of potassium in saliva, paper by Mr. H. L. Albert, 50.

Thomson, Mr., note on chloroform in dental surgery, 25; exhibited several teeth which had been stopped, 138.

Tomes, Mr. Charles, on odontomes, 24; on chloroform in dental surgery, 28; paper, partial suppression of teeth in a very hairy monkey, 30.

Turner, Mr. Joseph George, elected, 19.

Turton, Mr. Arthur W., elected, 1.

U.

Use of gutta percha, in conservative dentistry, paper by Mr. William Rushton, 105.

V.

Valedictory address, 198.

Van-der-Pant, Mr. F., proposed, 73; elected, 133.

W.

Wallis, Mr. C. J. Boyd, paper on formalin, 84; on antral empyema, 99; on persistent temporary teeth in a patient with dichotomous thumbs, 103; on gutta percha in conservative dentistry, 127.

Washbourn, Dr., on bacteriology of the mouth, 195.

West, Mr. Charles, notes of a case of persistent temporary teeth in a patient with dichotomous thumbs, 100.

Williams, Mr. H. Lloyd, notes on (*a*) cases of excision of roots, (*b*) open bite in an adult, 38; grinding down of teeth in Indians, 48; on catarrh of the antrum, 137.

Willis, Mr. George N., proposed, 19; elected, 45.

Wood, Mr. Henry, on chloroform in dental surgery, 29.

Woodhouse, Mr. William Barnabas, proposed, 37; elected, 73.

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